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THE GORGES AND WATERFALLS OF CENTRAL NEW YORK.*

BY

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NUMBER AND VARIETY.—There are few, if any, regions in the United States where, in so small an area, so great a number and variety of falls and gorges are found as in the valleys near the heads of Cayuga and Seneca Lakes. Many of these are of such wildness

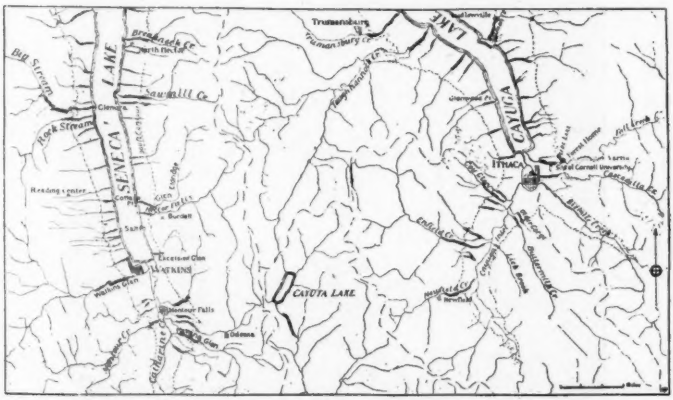


FIG. 1.—ITHACA, N. Y., AND SURROUNDINGS. THE BROAD PORTIONS OF THE STREAMS SHOW THE LOCATION OF SOME OF THE MORE IMPORTANT GORGES. 900-FOOT CONTOUR MARKED BY DOTTED LINE.

and beauty that, near large centres of population, they would long since have won wide reputation and attracted the thousands. Falls in Europe, to which annual pilgrimages are made by streams of tourists, including many Americans, are excelled in beauty and

* A brief abstract of this paper was presented before the International Geographic Congress at Washington in 1904.

interest by scores of falls in the central New York region, to which no names are yet given.

Among the many gorges or glens of this region only one, Wat-

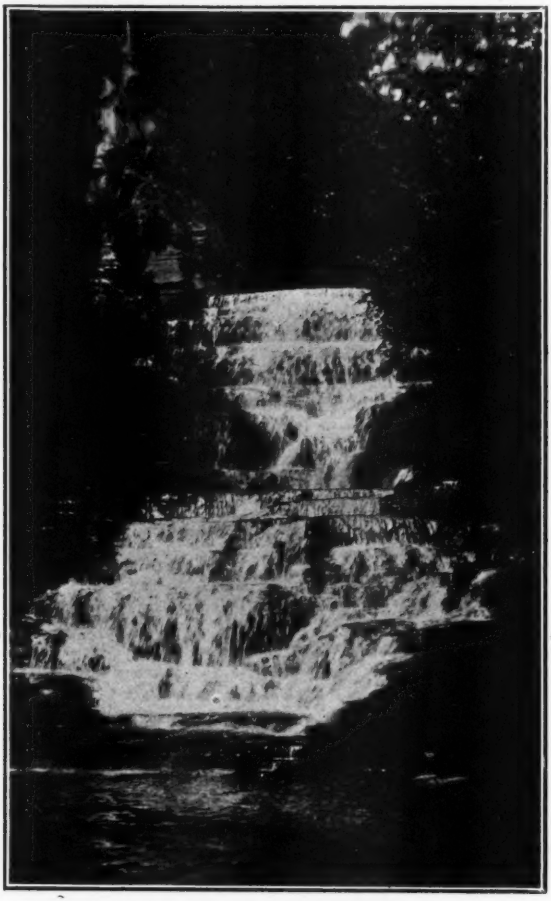


FIG. 2.—ONE OF THE NUMEROUS WATERFALLS, NEAR ITHACA, N. Y. THIS IS A TYPICAL STEP-FALL.

kins Glen, has attained wide reputation. To this glen tourists come in large numbers each summer; and a gorge nearby, Havana Glen, profits by the reputation of Watkins, and shares in the attention of these tourists. These two glens are beautiful, and it is well

worth one's while to make a long journey to see and enjoy the wild natural scenery which they contain. Yet they are only two of many, and those who know the region well will agree that others are at least their equal. Indeed, to the genuine lover of scenery many of the others have superior attraction, because the natural beauty is not marred by board sidewalks, ladders, and fantastic signs, such as Pluto's Fall, Bridal Chamber, etc., which the exploiters of the glens have deemed it necessary to hang in conspicuous places to arouse the interest of the horde. Nor are the less well-known glens infested with throngs of unsympathetic tourists and pleasure-seekers.

One who loves to wander about in the solitude of wild natural scenery, gaining every now and then a glimpse of a scene of rare beauty, and finding such scenes in quick succession and constant variety, could find employment for weeks, with each day full of interest and pleasure. He would return rested, refreshed, and inspired, and could easily bear away a record of the beauties of the region obtained by camera or by pencil.

The abundance of these gorges and falls in this locality has, of course, an explanation. This explanation is to be found partly in the peculiar physiographic history of the Finger Lake valleys, and partly in the rock structure, to which the details of gorge-form and waterfall outline are largely due. It is the purpose of this paper to consider both the general cause for the abundance of gorges and falls and the explanation for the more pronounced details of their topography. These considerations lead us along a number of different lines.

Topography of the Region.*—The Finger Lakes, of which Cayuga and Seneca are two, are situated in valleys in the dissected plateau of central New York. This plateau, which increases in ruggedness from north to south, is deeply cut by a network of valleys of mature form, the valley slopes, on the whole, being sufficiently moderate for farming, but with some slopes too steep for this, though tree-covered. Where not too steep the hill slopes are usually smooth and thinly veneered with glacial drift; but where crossed by morainic bands the drift-cover perceptibly thickens, and the minor details of topography become varied. Most of the valleys are deeply drift-filled, and often quite flat-bottomed.

Two of the main valleys of the plateau are occupied in part by Lakes Cayuga and Seneca; other similar valleys are partly occupied

* For another account of the topography of the region, and a bibliography of the literature on its physiography, see Tarr, Lake Cayuga a Rock Basin, *Bull. Geolog. Soc. Amer.* V, 1894, 339–356.

by the other Finger Lakes, Skaneateles, Owasco, Keuka, and Canandaigua. All these lakes drain northward, and outflow to the east-flowing Seneca River; and if there is any northward continuation of their valleys it is deeply buried beneath drift. The northern, or outlet, ends of the two largest lakes, Cayuga and Seneca, which extend in a general north-south direction, lie beyond the edge of the plateau on the Lake Shore plains, which extend from Lake Ontario southward to the northern escarpment of the plateau region. The southern, or inlet, ends are in the plateau, the hills on either side rising gradually to elevations of 1,600–2,000 feet above sea-level, or from 1 200 to 1,600 above the lake surfaces. The highest and most rugged part of the plateau is several miles south of the heads of the lakes. Along the northern edge of this most rugged portion is the divide between the Finger Lake drainage and that of the south-flowing Susquehanna. The divide of the Cayuga Valley is 14 miles south of the head of the lake; of the Seneca Valley 15 miles.

Each of the Finger Lakes occupies part of a valley which, in its general outline at least, is due to river erosion. The valleys are winding and, at first glance, seem in harmony with the rest of the topography, being merely longer and deeper than the tributary valleys. The length of Cayuga Lake is about 38 miles, and of Seneca 35 miles. Cayuga has a depth of 435 feet and Seneca 618 feet; but that the actual rock bottom is lower than this is indicated by the fact that a well-boring at Watkins, at the head of Seneca Lake, shows that the rock bottom is there fully 1,080 feet below the lake-level. These figures place the rock bottom of the Cayuga Valley at least 54 feet below sea-level, and of the Seneca Valley at least 637 feet below sea-level.

The lateral streams tributary to the Cayuga and Seneca troughs approach in broad, mature valleys to the very edge of the main valleys, and then end as hanging valleys* at an elevation of from 800 to 900 feet above sea-level, or 350 to 500 feet above the lake surface. In the Seneca Valley the bottoms of these hanging valleys are about 1,500 feet, and in the Cayuga Valley about 845 feet above the deepest-known point in the main valley. It is in descending from the edge of these hanging valleys to the lake valleys that the streams have cut the postglacial gorges which are so abundant. In addition to the postglacial gorge-cutting, there has been an earlier period of gorge-cutting antedating the time of deposit of the last glacial drift. These earlier gorges are broader, and hence

* Tarr, American Geologist, Vol. XXXIII, 1904, pp. 271–291.

required a longer period for formation than the postglacial gorges. That they are not postglacial is proved by the fact that they are more or less completely filled with morainic deposits. Where entered or crossed by the postglacial streams they introduce decided variety in the form and characteristics of the postglacial valleys.

THE BED ROCK.—The plateau in which the Finger Lakes lie is made of Devonian strata, mainly shales with sandy layers, increasing in abundance toward the top. There is every gradation from very friable shale to dense, fine-grained, well-cemented sandstone. The sandy beds are usually thin, and there are frequent and abrupt alternations from shale to sandstone. These alternations have an important influence on the form of the gorges and the outline of the waterfalls. The fact that the sandy layers increase toward the top of the series accounts, in part at least, for the greater elevation and ruggedness of the dissected plateau toward the south.

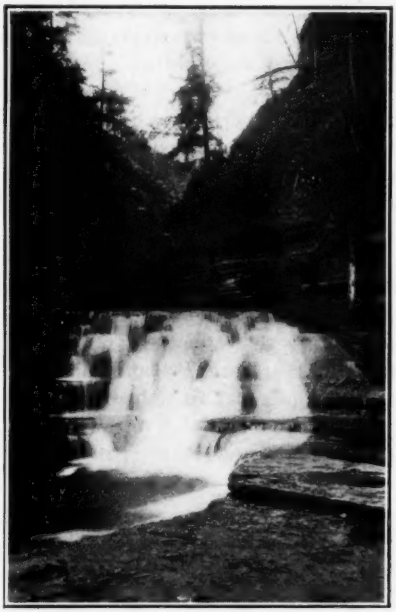


FIG. 3.—A FALL IN ENFIELD GLEN, NEAR ITHACA, N. Y., SHOWING THE INFLUENCE OF THE HORIZONTAL STRATA ON THE GORGE WALL AND WATERFALL OUTLINE.

Besides shale and sandstone there are, in the southern half of the lake valleys, two beds of limestone, only one of which, the Tully, is pronounced enough to produce an influence on the topography. This bed has a thickness along Cayuga Lake of about 15 feet, and, being a dense, massive layer in the midst of friable shales, resists denudation better than the surrounding strata.

All these strata are so nearly horizontal that, in considering their influence on topography, they may be classed as horizontal. However, the strata have a gentle southward dip, and they are slightly disturbed by a series of low folds, with approximately east-

west axes; but these are too broad and low to have a pronounced effect on the topography. The main valleys of Lakes Cayuga and Seneca cross the folds almost at right angles. There are also some very small faults and a number of dikes, whose influence on topography is too imperceptible to call for consideration, excepting in connection with subordinate details. Both the folding and faulting increase southward, beyond the heads of Lakes Cayuga and Seneca, and toward the region of Appalachian folding, with which these disturbances are doubtless connected.

The entire series of strata is crossed by numerous well-developed, approximately vertical joint planes, meeting at very nearly right angles. They vary somewhat in direction, and decidedly in abundance and perfection of development. In places they occur at intervals of a few inches, but more often of several feet, and they are rarely entirely absent in an area of twenty or thirty square feet. Sometimes both series of joints are equally developed, but more commonly one set is better developed than the other. Where opened and exposed by weathering, as in gorges and along the lake-shore cliffs, the joint planes are seen to have variable extent, from short breaks of only a few inches to great planes of breakage, traceable, both vertically and horizontally, for scores of feet. Naturally, therefore, the joint planes exert a profound influence on the topography. This influence is clearly seen in the details of gorge-form and waterfall outline, as well as in stream outline; how much influence it may have had on the larger topographic features is not now clear.

General Physiographical History.—The physiographical history of this region has been long and complex, and at present many of its phases are not understood. That the region has long been subjected to denudation is evident from the mature form of the valleys; but that this history has not been simple and uninterrupted is evident from many facts. Since the drainage history is not fully interpreted, and since much of it has only indirect bearing on the problems of this paper, no further consideration of the vague early history will now be undertaken.

Before the advent of the ice-sheet of the Glacial Period the sum total of the various drainage changes had produced a mature topography not greatly different, in general features, from that now found in the region. Stream-courses may have been different, and in some cases certainly were, and there have been many changes in the details of topography, including the formation of the post-glacial gorges. The advance of the ice-sheet, perhaps repeated

more than once, caused modifications of the topography, the full extent of which is not now apparent. By ice-action valleys were deepened somewhat by erosion; others were shallowed by drift deposit; portions of pre-existing valleys were transformed to lakes; and streams were, in many instances, turned out of their valleys, and even turned over to other systems. But all these changes were minor when compared to the systematic and widely-extended development of mature topography which characterizes the region, and which was the result of a long period of development.

THE HANGING VALLEYS.—At some relatively recent period in the drainage history of the region the hanging tributary valleys joined the main Cayuga and Seneca Valleys at a level not far from that of the 800–900 foot contours.* This conclusion is based upon the established fact that a mature valley has a moderate grade or bottom slope. At present the tributary streams have the moderate grade of maturity nearly to the end of the hanging valleys, then abruptly change their grade, and tumble down the main valley sides in steeply sloping, narrow gorges.

Taking one stream as a type, this change will be readily understood. Fall Creek (Fig. 4) which forms the northern boundary of

FIG. 4.—PROFILE OF FALL CREEK, WHICH DESCENDS THE CAYUCA VALLEY SLOPE ALONG THE NORTHERN BOUNDARY OF THE CORNELL UNIVERSITY CAMPUS. (VERTICAL SCALE EXAGGERATED ABOUT FIVE TIMES. COLUMN OF FIGURES GIVES ELEVATIONS IN FEET WITH REFERENCE TO SEA-LEVEL.)

Cornell University campus, has an average grade of 20 feet a mile in the first 25 miles of its course. Just above the University the stream quickens, and from this point onward until it reaches the Ithaca delta, which it has helped build at the head of Lake Cayuga, it descends 475 feet in a distance of 1½ miles. Could the lake-waters and sediment-filling of this valley be removed, the stream would descend at least 845 feet in 2 miles. Other streams illustrate the same change in slope; and, in the case of those in the Seneca Valley, taking Watkins Glen as a type, if the tributary streams could be continued down to the rock-floor of the main valley, their descent would be 1,500 feet in 2 miles.

These changes in slope are not due to the turning of streams out

*Tarr. Amer. Geol., Vol. XXXIII, 1904, pp. 271–291.

of their valleys, for there are no buried valleys to be correlated with these mature, upland, hanging tributary valleys. With the exception of small breaks where buried gorges descend to the main valleys, the rock-walls of the main valley sides can be traced continuously for miles along the 800–900 foot contours. Such a decided change in valley profile cannot be associated with the normal development of a mature valley. Therefore, some exceptional explanation must be sought, and this explanation must deal with causes which will account for the lowering of the main valley bottom below the level at which the hanging tributary valleys formerly entered the main valleys.

While there are several possible causes for the lowering of a valley bottom below the level of its tributaries, including block-faulting, only two seem possibly applicable to this region. One of these is ice erosion, deepening the main valley, but not affecting the tributaries, and therefore leaving the tributary valleys hanging above the bottom of the over-deepened main valleys. The other explanation is that some marked increase in the cutting power of the main streams, through uplift or other cause, permitted them to deepen their valleys rapidly, while the side valleys, occupied by weaker streams, were not deepened to such a degree. This new power given to the streams is called rejuvenation.

Ice erosion has been the current explanation of hanging valleys, and was applied to the Finger Lake region by Lincoln * as early as 1892, and by myself in 1894 †. Later studies, have, however, tended to discredit the glacial erosion hypothesis, and to give support to the rejuvenation hypothesis. This subject, and its application to the Finger Lake region, has been discussed in another paper ‡ in which it is shown that, while the evidence at hand is not sufficient to establish the rejuvenation hypothesis, it favors this rather than the explanation by ice erosion.

Whichever of the hypotheses the future discovery of evidence establishes will not alter the fact of main importance, from the standpoint of the present paper—namely, that over-deepening of the main Cayuga and Seneca Valleys has made it necessary for the tributary streams to descend by steep slopes over the walls of the over-deepened lake valleys, and in them to cut the gorges and form the waterfalls with which the region abounds. The fact that the gorge-cutting of the present cycle is postglacial has so limited the time available for valley-deepening that the streams, even where

*Amer. Journ. Sci. Vol. XLIV, 1892, pp. 290–301.
†Bull. Geol. Soc. Amer. V, 1894, 339–356.
‡Tarr, Amer. Geologist, Vol. XXXIII, 1904, 271–291.

working in soft shale, and notwithstanding their great slope, have been able to cut only small gorges; and, not being able in this short time to establish a moderate grade, the stream-courses are consequently interrupted by a succession of waterfalls.

THE BURIED GORGES.—In all the valleys so far examined older gorges, more or less drift-filled, have been discovered. In some cases the drift-filling completely obscures the older gorges and causes the postglacial streams to follow an entirely different course to the main valley, but more frequently the buried gorges are revealed by the downcutting of the postglacial streams which cross and, in some cases, follow them for a distance. These gorges are steep-walled, like the postglacial gorges, but are decidedly broader, and hence required a much longer time for their formation. In time of origin they can be certainly placed somewhere between the period of development of the mature tributary valleys and the last ice advance.

For some reason, as yet uncertain, the streams had their power of downcutting increased after the mature valleys were developed, and the result was the cutting of this series of gorges in the bottoms of the mature valleys. As in the case of the over-deepening of the main valleys, there are two possible explanations for this increase in stream power, and the solution of the one problem will solve the other. If the main valleys have been over-deepened by ice erosion the gorges are evidently to be interpreted as the result of stream-cutting during interglacial time, when a new, lower base-level had been established by glacial erosion during an earlier ice advance. If the main valleys have been deepened by rejuvenation through uplift, the side valley gorges represent the measure of cutting which the weaker members of the system were able to perform while the main streams were lowering their valleys to the present depth.

The solution of this problem is not yet at hand; but the fact of importance to the present paper is established—that there is a system of older, partly-buried gorges which must be considered in any attempt to understand and interpret the features of the gorges and falls of central New York. The grade of these gorges is not known, since their bottoms are obscured by drift-filling.

THE POSTGLACIAL GORGES.—When the glacier disappeared, and drainage was re-established on the land which the ice had left, the water followed the lowest courses opened to it. Naturally, in the mature upland valleys the stream-courses were approximately

along the lines of the preglacial drainage, though by drift deposits or other glacial interference, streams were often caused to depart from the exact direction or position of preglacial stream-flow. Rarely, in these upper portions of the larger streams, has the work of erosion removed the drift down to the bed-rock. The valley-bottom grade has not been steep enough for much stream-cutting, and at best the postglacial work has resulted in the erosion of young, narrow valleys in the drift.

Approaching the lower end of the hanging valleys the slope increases, the stream-flow quickens, and the gorge-cutting begins. Thence on to the main valley the tributary streams, large and small, flow almost, if not quite, continuously in postglacial rock gorges, which the streams are now busily cutting in the rock walls of the main valleys. For these reasons there is a decided change in the character of the lower and upper portions of nearly all the streams entering the southern end of the Cayuga and Seneca Valleys (Fig. 1); and this change occurs approximately at the edge of the hanging valleys.

FIG. 5.—WATKINS GLEN, A POSTGLACIAL GORGE WHICH THE STREAM IS NOW RAPIDLY DEEPENING AS IT DESCENDS THE STEEPENED SLOPE OF THE SENECA VALLEY IN A SUCCESSION OF LEAPS.

Near the level where this change in slope occurs there have been two prominent causes for an unusual depth of drift. One of the lateral moraines of the Cayuga and Seneca Valley ice-tongues extends at about this level; and at a still later stage, when the retreating ice-sheet stretched across these lake valleys, forming a great ice-dam, delta terraces of gravel and sand were built at the mouth of each of the streams in the temporary lake. These drift obstructions have decidedly modified the courses pursued by the streams

below the edge of the hanging valleys. Therefore it happens that, although there are pronounced earlier gorges extending down the slope below the edge of all the hanging valleys, and sometimes forming distinctly-marked depressions in the main valley slope, the postglacial streams do not always follow them, or, if they do, in many instances follow them for only a part of the distance. This fact has a profound influence on the forms assumed by the gorges of this region.

Effect of Buried Gorges.—Where a postglacial stream coincides with a section of a buried gorge, it has had an easy task to perform, merely stripping away the glacial drift. Since the buried gorges are broader than the postglacial rock gorges the valleys cut in postglacial time are distinctly broader where they coincide with the older gorges than where a new gorge has been cut in the rock. Furthermore, the buried gorges were cut to a greater depth than has been possible in the brief postglacial time, and therefore those streams which coincide with the buried gorges in their lower ends have deeper valleys than those which occupy postglacial gorges in their lower ends.

This condition may be well illustrated by briefly considering two contrasted instances. One of these is lower Six Mile Creek, which enters the Cayuga Valley from the east at Ithaca. About one mile from the point where this stream emerges upon the Ithaca delta it is flowing in a narrow postglacial gorge cut in the northeast wall of the buried gorge. In this section a picturesque fall has been developed. The stream then enters the buried gorge, whose further course upstream is partly hidden by drift deposits. In consequence of the discovery of this buried gorge by the stream the valley abruptly broadens, and this condition continues to the point where the creek emerges upon the Ithaca delta. This broad lower valley is a rock-walled gorge, with precipitous sides, but with the rock bottom nowhere revealed. The postglacial stream has only partially removed the drift-filling of the earlier gorge.

Of exactly the opposite type is Buttermilk Creek, the next stream to the south on the same (east) side of Cayuga Valley. At about the 800-foot level—that is, at the edge of the hanging valley—the creek is turned by moraine and delta deposits entirely aside from its buried gorge section. Consequently it enters the Cayuga Valley over the rock wall of the main valley several hundred yards south of the buried gorge, whose course is plainly traceable by a deep sag in the hillside and by occasional outcroppings of the gorge walls above the moraine-filling. Because of this diversion

of the creek, the postglacial work of lower Buttermilk has been entirely in the bed-rock; and below the 800-foot level the gorge is, therefore, entirely of postglacial origin. It is in striking contrast to lower Six Mile Creek; for its gorge is narrow, the rock is everywhere present in its bed, and the slope is so steep that the stream forms a succession of rapids and falls. For part of the distance the stream flows almost flush with the main valley wall, having been incompetent to wear down its bed sufficiently to form a deep gorge.

Between the extreme types of Six Mile and Buttermilk Creeks there are numerous gradations; and there are a number of gorges which are possibly due to a combination of early and postglacial gorge-cutting. Lower Fall Creek, lower Taughannock, and a number of smaller streams are in broad gorges, with rock bottoms. In these instances it has not been proved beyond question, as it has been in Six Mile Creek, that the earlier gorge is occupied by the postglacial stream, and future study may prove that this is not the case; but the great breadth of these gorges is otherwise difficult to explain.

In several cases streams of similar volume, in approximately the same kind of rock, and with about the same grade, are occupying gorges markedly different in width and depth. This may be illustrated by comparing two small stream gorges with that of Buttermilk. Lick Brook, south of Buttermilk, and Esty Glen, north of Ithaca, both on the east side of the valley, have cut more pronounced gorges than lower Buttermilk, which is unquestionably entirely postglacial. Yet Buttermilk has much greater volume of water than either of the others; the grade of Buttermilk Creek is as great as that of Esty Creek and nearly as great as Lick Brook; and the rock is not greatly different. I am at a loss to account for this discrepancy on any other hypothesis than that both the Lick and Esty streams are occupying their earlier gorges; and this explanation is further strengthened by the fact that the older gorges of Esty Glen Stream and Lick Brook have not been found. A similar explanation is offered to account for many other cases of broad, deep lower gorge sections. It cannot be considered established; but with further investigation, now in progress, the correctness of the hypothesis will doubtless be fully tested. If this hypothesis proves incorrect, some other explanation will need to be found for the very striking difference in the depth and width of gorges which at first sight seem to be entirely postglacial in age.

In still another way the buried gorges influence the valley-

forms. Where the streams cross the moraine and delta deposits, near the point where the slope changes from that of the hanging valleys to that of the main valley walls, they have often been given an irregular course. In the down-cutting through the drift to the underlying rock this postglacial course oftentimes leads to a cross-sectioning of the buried valleys, which the postglacial streams usually cross diagonally. This is exceedingly well illustrated in middle Six Mile Creek (Figs. 6, 7 and 9) above its lower course in the buried valley described above. Three times the creek crosses its buried

FIG. 6.—AN "AMPHITHEATRE" IN SIX MILE CREEK, LOOKING DOWN STREAM TOWARD THE DAM SITE (FIG. 7), WHICH IS SITUATED AT THE LOWEST POINT IN THE SKY LINE. THIS AMPHITHEATRE IS NOW FLOODED BY MEANS OF A DAM IN THE POSTGLACIAL GORGE (FIG. 7).

gorge, each time entering it through one wall and leaving it across the opposite wall. In each case the valley-form changes abruptly as the stream enters and leaves the buried gorge. The postglacial section, cut in the buried gorge wall, is always narrow, with rock walls and rock bottom, over which the stream flows with rapids, or falls, or both. But in emerging into the buried gorges the valley abruptly broadens, rock is absent from the stream-bed, and on each side there is a section where rock is entirely absent from the valley sides. In these broad sections the stream meanders, forming terraces in the drift. Such broad sections are locally known as "amphitheatres." They make excellent sites for ponds, the outlet gorges being excellent dam sites (Fig. 7), and the breadth and gentle bottom slope of the "amphitheatres" being well suited for the

existence of ponds. Two of the "amphitheatres" of Six Mile Creek have been utilized for this purpose.

Other streams show the same condition. One of the best instances is that forming the site for the pond, called Beebe Lake, which contains the water supply for Cornell University and supplies the power for lighting the University and for its hydraulic laboratory. This is in Fall Creek, which forms the northern boundary of the Campus. Just above Forest Home, about one mile east of the University, the creek is in the older gorge, having up to this point a moderate grade in the hanging valley. At Forest Home the creek turns northward, having been deflected by a morainic spur; and, on cutting down through the moraine, it has encountered the rock of the northern wall of the buried gorge. In this a narrow postglacial gorge has been cut, with several rapids and falls. In the course of a few hundred yards the stream turns and reenters the buried gorge, which it crosses diagonally, entering the rock of the south wall at a distance of about a quarter of a mile from the point where it entered the buried gorge. Here it cuts another postglacial gorge with a series of very beautiful falls, much of whose beauty still remains, notwithstanding the building of a dam and the construction of a hydraulic laboratory in the gorge.

FIG. 7.—POSTGLACIAL GORGE IN SIX MILE CREEK, BELOW AN AMPHITHEATRE (FIG. 6). THIS IS NOW OCCUPIED BY A DAM AND A POND FILLS THE AMPHITHEATRE ABOVE.

These descriptions may be considered typical of conditions which are very common in the tributaries of Cayuga and Seneca Valleys. In this way scores of narrowing and broadening sections of the gorge valleys are explained.

EFFECT OF STRATA.—Being horizontal, the effects of differences in the strata on the gorge-form and waterfall outline are all of one general nature. On the gorge-walls the variations in texture cause a nearly horizontal banding, due to differences in resistance to weather-

ing by the various strata. The effect varies greatly (Figs. 2, 3 and 5) according to the thickness of the various strata, the differences in durability of the successive layers, and the frequency of occurrence of hard layers. Every gorge shows some effect of this influence in the minor details of gorge-form; and sometimes it is very pronounced, especially where there are fairly thick layers of unusual hardness. In such cases there is sometimes an overhanging of portions of the gorge-wall where either undercutting by the stream or weathering out of weak strata has occurred beneath hard layers. These differences in rock strata are, however, nowhere great enough to give to the gorge-walls a distinctly terraced form.

The resistance of durable layers to the down-cutting of the streams is the cause for most of the rapids and falls of this region; but there are many differences among the falls, as a result of the varying conditions under which the strata occur. The differences in influence of strata may best be illustrated by means of a few type cases.

Only one of the strata of this section, the Tully limestone, is thick and massive enough to cause high falls over a single layer. Wherever the water flows over this layer, even in small streams, there is a pronounced fall, which, in all respects but size, closely resembles Niagara. The undermining of this limestone by removal of the underlying weak shale leaves it overhanging; a pothole is bored out at the base of the fall; and, by the falling of undermined blocks of the horizontal limestone, the fall gradually retreats upstream.

On a much smaller scale a similar condition is introduced by scores of thin sandstone strata. Usually, in such cases, only a low fall is caused, or perhaps no more than a rapid. Where the hard strata are near together the combined effect of several produces a step-fall (Figs. 2 and 3), which may attain considerable height if there are enough hard layers. Such a fall seems inclined, when viewed as a whole, but actually consists of a series of step-falls, each set a little back of the next one below. The inclined step-falls, well illustrated by Buttermilk Fall, are very often found where the postglacial stream has been precipitated down the steep face of the main valley wall into which time has not yet permitted the cutting of a deep gorge. On account of the exceedingly great variety in thickness, number, and spacing of the hard layers there is a great variety in the form of the falls, as may be inferred from the accompanying pictures.

Effect of Joint Planes.—The details of gorge and waterfall form are profoundly influenced by the joint planes, by the aid of which

the rock cleaves readily along the nearly vertical planes, which meet at almost right angles. This causes a rectangular buttressing of the gorge outline as one of the most characteristic features of the gorge-wall form (Fig. 8). The presence of several joint planes close together often permits the formation of a narrow chasm; and a combination of two such sets, at right angles, at times isolates a

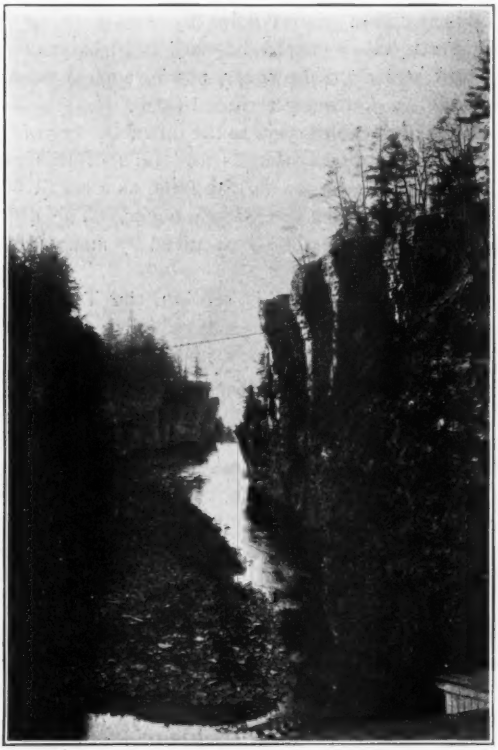


FIG. 8.—BUTTRESSES ON WALL OF FALL CREEK GORGE ITHACA, N. Y., DUE TO THE INFLUENCE OF JOINT PLANES.

portion of the gorge-wall, leaving it standing as a column. The falling away of fragments along the joint planes leaves many smooth faces on the gorge-walls; and the formation of talus slopes at the bases of the cliffs, as well as the widening of the gorges, is greatly facilitated by the influence of the joint planes. Fresh scars caused by the recent falls of fragments weathered loose along joint planes may be seen each spring in most of the gorges.

The streams are often deflected by joint planes, sometimes occupying the space between two joints for a long distance, then, perhaps, turning at right angles to follow the other set for a distance. The presence of these joints greatly facilitates the stream work of valley-deepening.

Even more marked is the influence of joints on the form of the waterfalls. They guide the water in its course, often causing angular outlines in the waterfall (Fig. 9); and, by causing the rock to cleave, they sometimes give to the fall a vertical form where otherwise the stream would have an inclined slope. This is exceedingly well illustrated in the extreme case of Taughannock, the highest waterfall in the State, which has a vertical fall of 190 feet. There is no hard layer at the crest of Taughannock, but the fall occurs at a part of the gorge where both sets of joint planes are exceedingly well developed. At intervals varying from a few inches to several feet the joint planes cut the rock into vertical sheets, in some cases extending from the top to the bottom of the gorge. Frost and weather cause the rock to cleave along these planes so frequently that the face is left vertical. The very outline of the waterfall crest is determined by the joints. At present (Fig. 10) the outline of the crest is a re-entrant angle, due to the meeting of two joint planes; a few years ago (Fig. 10) the crest of the fall protruded to the opposite angle of the rhomb formed by two other parallel joint planes. The fall of the rhombic (almost cubical) block enclosed by the joint planes has caused a decided change in the outline of the

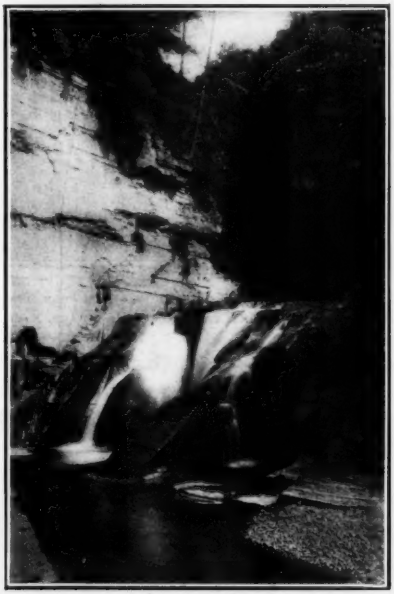
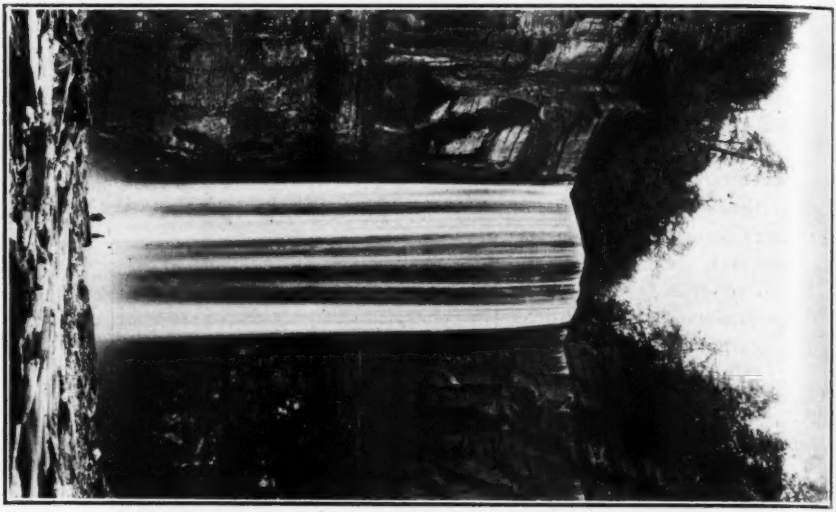


FIG. 9.—GREEN TREE FALL, SIX MILE CREEK, NEAR ITHACA, N. Y., SHOWING INFLUENCE OF JOINT PLANES ON WATERFALL FORM. THIS FALL IS AT THE POINT WHERE THE CREEK EMERGES FROM A POSTGLACIAL GORGE INTO ITS BURIED GORGE AT THE AMPHITHEATRE (FIG. 6). THIS IS IN THE NORTH WALL OF THE BURIED GORGE; FIGURE 7 IS IN THE SOUTH WALL.



TAUGHANNOCK—OLD OUTLINE.

FIG 10.—TAUGHANNOCK FALL, NORTH OF ITHACA, N. Y., ON WEST SIDE OF CAYUGA LAKE.

TAUGHANNOCK FALL—NEW OUTLINE.

DUE TO RECESSION BY FALLING AWAY OF A JOINT PLANE BLOCK.

fall. Almost every waterfall of good size is influenced either slightly or profoundly by the joint planes.

INFLUENCE OF THE GORGES AND FALLS.—In many ways these gorges have influence on life. They are usually a wilderness in the midst of a farming region. Therefore their flora and fauna are different from that of the surrounding land; and this difference is increased by the dampness and shade of the narrow gorges. To show the exact amount of difference in life is a task for the ecologist.

These strips of wilderness cut up single farms and interfere with communication between neighbouring farms. They deflect roads or else cause the construction of expensive bridges. For example, until four or five years ago there was no road bridge across the Fall Creek gorge, although it forms the northern boundary of the Cornell Campus, and the University buildings extend to the very edge of the gorge. The building of a bridge quickly opened up the region on the opposite side of the gorge, and in five years it has become one of the important residential sections of Ithaca.

The gorges also influence the railroads. Thus, the Delaware, Lackawanna and Western Railway enters Ithaca by means of a switchback, causing an increase in distance and consequent delay, and introducing a very heavy grade, down the steepened valley slope, to avoid the expensive construction necessary to enter by a more direct course—along the Six Mile Creek valley, into which enter many small tributaries in deep gorges. The Lehigh Valley Railway decided against the Ithaca route for its main line, building a double-track road, at heavy expense, through the Seneca Valley, at the level of the steepened slope, above the upper ends of the gorges. To use the Ithaca route it was necessary either to descend to Ithaca by steep grade and ascend by even steeper grade, along the route followed by the present Ithaca branch, or else to establish a grade on the hillside and bridge a number of deep gorges.

As already stated, the amphitheatres are natural sites for storage reservoirs, and are used for this purpose in a number of instances, partly for water supply, partly for power. The Ithaca water supply, as well as that of Cornell University, is at present obtained from the creeks, dammed at the lower ends of amphitheatres. The many falls give ample opportunity for power wherever the water supply is sufficient. Unfortunately, in most cases the water supply is limited and variable, and the variability is being steadily increased by the continued removal of the woodlands, thus making this source of power even less useful than formerly. The

creeks, at times roaring torrents, are greatly lowered in summer by drought, and in winter by frost; and industries requiring steady power are in many cases required to supplement the water-power by steam. Yet there are numerous small industries, such as grist mills, which make use of the power. Ithaca owes its early growth in part to the water-power available in the neighbouring creeks.

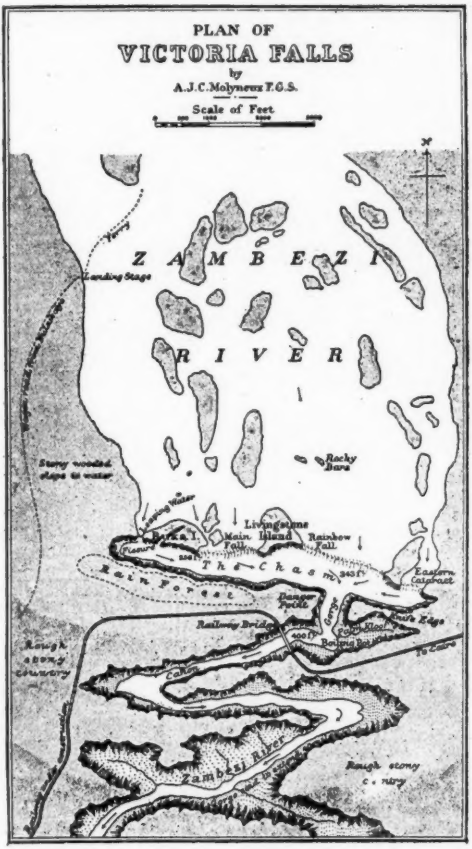
The use of the creeks for this purpose is diminishing, and at present the most varied and extensive use of water-power in this neighbourhood is that made by Cornell University, which obtains from Fall Creek not only its water supply, but also power for developing electricity for lighting its buildings, power for the engineering shops, and water for its hydraulic laboratory.

Not the least important influence of the gorges and waterfalls is the influence of their beauty on those who know them. This influence defies attempt at quantitative statement. It has a direct money value in the case of Watkins and Havana Glens, where there are gate receipts for entrance; but the value to the many tourists cannot be estimated. The reputation of Watkins Glen has led to an effort, maintained for several years, but as yet unsuccessful, to have it made a State Park.

Even more important than this, however, is the influence of the beautiful scenery upon the throngs of students who attend Cornell University. Some, it is true, never see any of the natural scenery excepting that which is forced upon them in crossing the gorges as they pass to and fro from their work; but the majority explore the gorges near by, and many extend their explorations far and wide. The influence of beautiful surroundings on character is unquestionably great, and the thousands who study at Cornell University have this influence thrust upon them.

THE VICTORIA FALLS OF THE ZAMBEZI.

Mr. A. J. C. Molyneux has a very interesting article in the *Geographical Journal* (January, 1905) on the physical history of the Victoria Falls. He expresses the opinion that the theory of Dr. Livingstone that a deep fissure was opened in the earth's crust across the bed of the Zambezi, the Victoria Falls being the result of this convulsion of Nature, is not correct, though still generally accepted. "I hold the firm conviction," says the writer, "that here, no less than at Niagara, the combination of cañon, gorge, chasm, and falls is due to the ever-reducing action of moving water, eating back with relentless energy, year by year, and age after age, into the hard and stubborn wall of igneous rock."



The article is illustrated with some fine views of the Falls. The accompanying map is reproduced from the *Geographical Journal*, in reduced size.

In his paper Mr. Molyneux applies names as follows: "The Chasm" is the cleft into which the river falls; "The Gorge" (that is, the throat) is the exit as far as the "Boiling Pot"; then the "Grand Cañon" commences and extends for 40 miles.

Summing up the various features of the Falls, Mr. Molyneux says that the chasm across the river is little more than 1,860 yards long —the same as the breadth of the river—that number being fixed upon as indicating the year in which the Falls were first carefully observed. The lip of the Falls is subdivided by natural features, as follows:

Nearest to the right bank is the misnamed "Devil's Cataract" ("Leaping Water" of Baines), 36 yards wide—a sloping mill-race that carries much water when many other portions are dry at low water. Next comes the island of Boaruka, about 200 yards wide, cut by a stream and fissure through which water pours at flood times; then comes the Great Fall, 573 yards broad, divided from a second fall of 325 yards by a projecting rock. At the east end of this fall is Garden Island, now known as Livingstone Island, lying on the very edge of the precipice, some 1,170 yards from the west side and 600 yards from the east shore. At the end of the chasm is the Eastern Cataract, a mill-race something similar to the "Leaping Water." This part of the Falls east of the island is mostly bare in the time of low water, and then gives passage to many isolated and narrow streams. The west end of the chasm is but 256 feet deep, as measured by Mr. Mansergh, the railway engineer, increasing to 343 in depth at the orifice of the chasm and increasing to 400 feet below the Boiling Pot. The chasm near each end is not more than 80 or 100 feet wide, increasing to 240 feet in the centre.

The water dropping over the Falls nearest the banks has now to turn at right angles and run the gauntlet past that falling over the centre, for the only outlet is the gorge of about 100 feet in width. Here, again, the right angle is in evidence, and the southerly course is now resumed. But not for long; 130 yards farther it enters the Boiling Pot, and emerges therefrom to run in a trench of 1,170 yards long parallel to the first. Only the portion of this parallel trench west of the Boiling Pot is occupied by the stream, the eastern end being now dry, and nursing in its sunlit depths the vegetation of the Palm Kloof. This end is divided from the chasm by a very narrow ridge of rock called the Knife Edge, the western end by a wide promontory (on which river pebbles can be found), with a base 416 yards wide, now carrying the Rain Forest. In the

writer's opinion this is an old Falls chasm, dating from a time when the river passed over the ridge now occupied by the Rain Forest promontory, Danger Point, and the Knife Edge, the depression at the east end of which is the extension of the eastern cataract.

At the land end of the Rain Forest promontory the cañon takes a bend at an acute angle to the east in a third cleft, then glides round a third promontory to form a fourth chasm running westward. Beyond this the zigzag course continues, and little is then known of its vagaries through the forty miles of the Grand Cañon.

In considering the processes which formed the falls, Mr. Molyneux says that the river has removed the upper strata of fine sandstones, and consequently the level of the stream, the lower flats of the valley, the ends of the chasm, and the edges of the gorge and cañon can be seen to be of the same horizon of basaltic rock (Columnar). The apron of water and inaccessibility prevent one seeing if the hard-top sheet extends in depth for the whole 400 feet of the chasm, but down the cañon it can be noticed that the lava lies in beds of varying thickness. The examination of these strata is not possible unless one is slung over the precipice—a feat not yet attempted. The hard surface is a basalt more or less amygdaloidal, on the degree of which quality depends its want of tenacity.

As is common to all rocks of this nature, it is full of cracks and fissures, due to contraction on cooling, and though it does not assume the perfectly regular hexagonal columns of the Giant's Causeway, or of Staffa, yet it frequently resembles them, the vertical cracks producing a general columnar form. The columns thus defined may be seen when the water is low, along the lip of the falls and beneath the clear and rushing current of the "Leaping Water" (Devil's Cataract), more or less truncated as the verge is reached, and bearing but little evidence of attrition. Indeed, evidence of actual wearing away of the angular edge of the precipice is conspicuously absent, and the level of the stream is almost unchanged up to the very lip of the falls. Only at the two cataracts at the ends of the chasm can the process of trituration be called in aid as a demolishing agent, and even here it is probable that the columns have been truncated by the action of the rushing water forced into the horizontal joints.

Mr. Molyneux believes that the cutting back of the edge is due to the perpetual hammering action of the vast bodies of water falling into and down upon the cracks between the basalt columns, assisted by the constant vibration of the rock from the precipitated

masses of water, and that by this constantly exerted force the columns are rent asunder and fall into the chasm, taking with them huge and deep flakes of the precipice. At low-water heaps of these blocks, as yet angular and unreduced, may be seen in the shallower ends of the chasm.

While there are signs some distance away that the basalt-flows are bedded in various degrees of tenacity, there is no sign of undermining of the rock that forms the rim, as at Niagara, and so leaving that rim without support; rather does the lower portion of the precipice at places protrude outwards. But the breaking down of the rock is mostly columnar; hence the almost vertical walls of falls, chasm, gorge, and cañon.

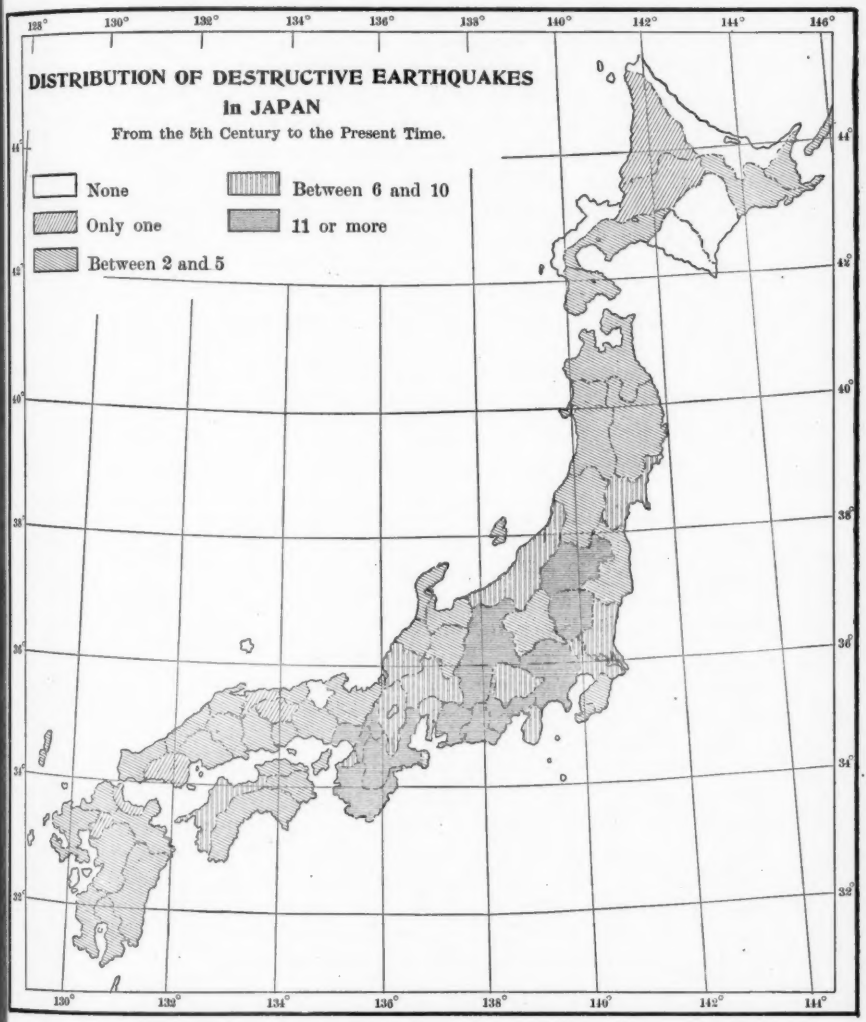
The writer thinks such are the causes that have played the most important rôle in the trenching of this length of forty miles.

EARTHQUAKES IN JAPAN.

The number of earthquakes in Japan in the year 1903 was 1,349. The *Publications of the Earthquake Investigation Committee*, No. 19, says that this is by no means more than the annual average. While Japan is pre-eminently a land of earthquakes, the shocks that are sufficiently severe to cause loss of life or serious damage to property are not numerous when compared with the total number of movements. Since 1872 fifteen earthquakes in Japan have been attended with serious consequences. It is only within a comparatively short time that the invention of the seismograph has made it possible to take note of the minor shocks; but over 2,000 earthquakes were recorded in the history of Japan between 416 and 1867 of the Christian Era.

The accompanying map is taken from No. 19 of the *Publications*. It shows the distribution of earthquakes that have caused loss of life and large destruction of property in Japan from the Fifth Century to the present time. There have been in all 223 of these violent earthquakes; 149 were limited in their destructive effects to one province of the empire and 74 extended over two or more provinces. Destructive earthquakes on the concave or Japan Sea side of the archipelago, as a rule, have smaller extent than those which occur on the convex or Pacific side. Of the 223 destructive

earthquakes, the place of origin of 47 was plainly in the Pacific; of 17, in the Japan Sea; of 2, in the Inland Sea; while the epicen-



tral tract or place of origin of 114 was inland, and the origin of 43 shocks was obscure. Of the 47 destructive earthquakes of Pacific origin, 23 were accompanied by *tsunami* or sea-waves, which have

often caused much more damage than the earthquakes themselves.

It is seen from another map in the *Publications* that the sea-waves accompanying earthquakes are almost entirely confined to the Pacific coast, there being only two exceptions.

One of the most destructive earthquakes was the great Mino-Owari catastrophe in October, 1891, in which over 7,000 people were killed, over 17,000 injured, and nearly 20,000 buildings destroyed, besides many bridges and other public works. It was this calamity that led to the establishment of the Earthquake Investigation Committee to discover (1) whether there are any means of predicting earthquakes, and (2) to ascertain what may be done to reduce the disastrous effects to a minimum by the choice of proper structures, materials, building sites, etc. This Committee, taking a liberal view of its functions, has not hesitated to make any investigations that would throw light upon the whole subject. The Committee is composed of twenty-four members, all scientific men or engineers, and it has thus far published forty-seven reports in Japanese and sixteen in foreign languages, chiefly English.

The recent seismological investigations in Japan are almost wholly the work of the Committee, in conjunction with the Seismological Institute of the Tokyo University.

Its statistical work consists chiefly of collecting records and reports of earthquakes and of the destructive sea-waves that accompany some of them. From these data are deduced the distribution of earthquakes in time and area; their relation to the seasons, the phases of the moon, the time of day, and the meteorological conditions.

Instrumental observations are carried on with seismometers and seismographs. These investigations include inquiries into the construction of instruments, their improvement, the invention of new ones, etc. From these observations are deduced the nature of the vibrations of earth particles, their amplitude and period, the velocity of earthquake waves, etc. As seismographs now record earthquakes the world around, the Committee has the means of studying the effects of distant earthquakes in Japan.

The geological investigations include reports of volcanic eruptions, geological dislocations, etc. Under this heading comes also the Vulcanological Survey, whose object is "to study the new and old volcanoes of our country as regards their internal structure, their rocks, their foundations, and their modes of distribution," so

as to be able to get "an insight into the structure of the land"; and "to construct the geotectonic map, by means of which we may possibly learn the conditions underground and the causes of regional shaking and the local points of earthquakes."

There are also investigations of such physical phenomena as may have some relation with seismic phenomena with a view to ascertaining whether such relation actually exists, and, if so, what is its nature. Among these are earth magnetism, gravity, underground temperatures, and elasticity of rocks.

A practical side of the work is one of the two ultimate objects for which the Committee was organized. It comprises investigations of earthquake-proof structures, best forms of chimneys, piers, columns, etc.; the strength of materials and combinations of materials, and so on. The committee has also extended its work to the application of seismometrical instruments, to the measurement of vibrations of the ground, and of vibrations of buildings and structures, due to causes other than earthquakes, such as passing of trains over bridges, hammering in factories, and the like, and to an examination of their effects.

The Committee has given much study to the construction of brick and wooden buildings that shall be as nearly earthquake-proof as possible. A number of plans and elevations of such buildings, and the methods of bracing and strengthening them so that they shall offer all possible resistance to earth movement, appear in *Publication* 19.

An International Seismological Association is now in course of organization. It is expected primarily to concern itself with the study and discussion of earth movements. The hope is expressed by the Japanese Earthquake Investigation Committee that it may, either by itself or in co-operation with other bodies, take into consideration all the principal problems relating to seismology.

The Japanese Committee has done some work which in its application will be useful in many countries. Such results, for example, as the determinations of the vibrations of railroad bridge piers, of the deflection and vibrations of girders and trusses, of vibrations of railroad and electric cars and of ships, will be of interest and use to engineers in all parts of the world.

The report says with regard to the prediction of earthquakes that it is not to be expected that the Committee should be able to accomplish so difficult a task within a short time; but there is no reason to assume that by persevering in this and other lines of investigation such a knowledge of earthquakes may not finally be

attained as to justify earthquake predictions. This view will probably be regarded as sanguine by the important number of seismologists who say that, as yet, not a particle of progress has been made in this direction, and who believe that predictions of some merit, but still large liability to error, would almost be worse for the people of earthquake countries than the calamities themselves.

LAUNCHING OF THE "ROOSEVELT."

The Peary Arctic Club's new ship was launched at Bucksport, Me., March 23, at 12.35 P.M.

Conditions of weather and tide were particularly favourable, and the event was characterized throughout by uniform smoothness.

When the binding timbers which held the ship on the ways were severed, Mrs. Peary smashed a bottle of champagne, imbedded in a block of ice, against the ship's stem, and christened her "Roosevelt."

The ship slid slowly and smoothly into the water, and moved gracefully across the narrow channel of the Penobscot, where she was taken in charge by a tug and towed to her pier.

Telegrams were immediately sent to President Roosevelt, and President Jesup, of the Club.

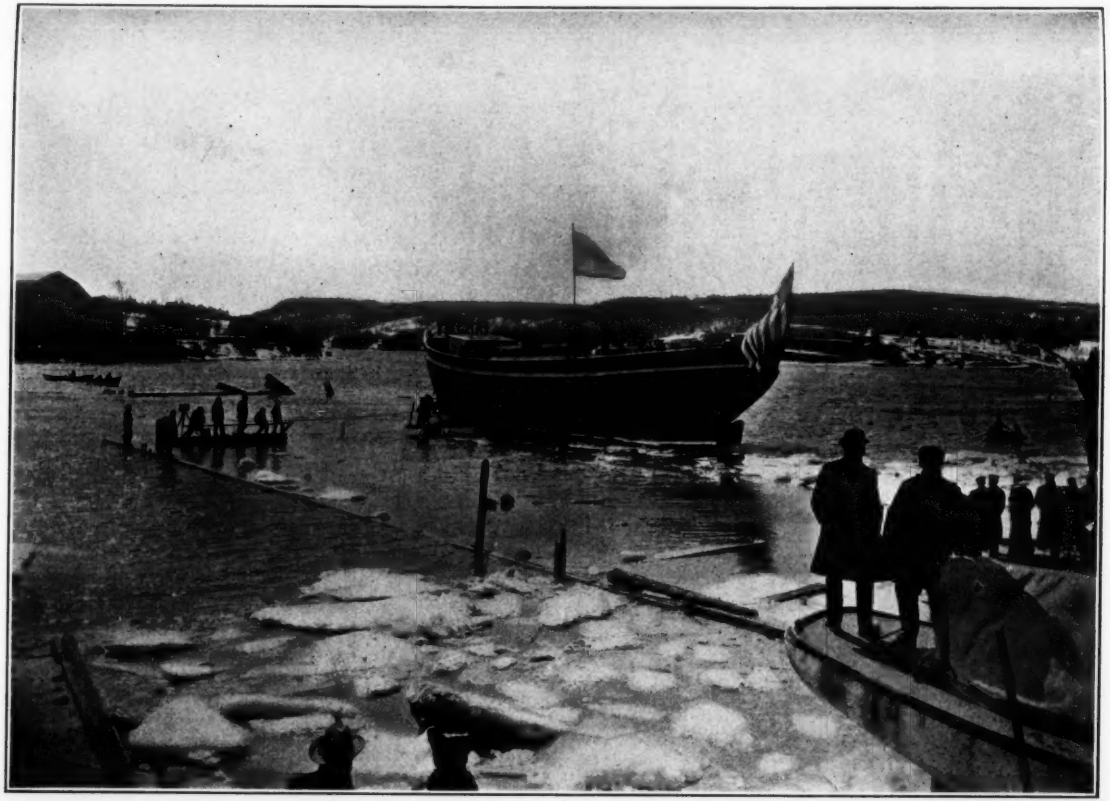
Some 5,000 visitors witnessed the launching, and greeted the vessel and her name with cheers.

The official measurements of the ship are: length, 182 feet; breadth, 35.5 feet; depth, 16.2 feet. Her mean draft will be 16 feet, and her full load displacement about 1,500 tons.

The preliminary plans and studies of the ship, embodying Peary's ideas, were prepared by Wm. E. Winant, Naval Architect in the Bureau of Construction and Repair of the Navy.

On these plans expert opinions were secured, and various modifications made. Finally the massive construction and essential special features of the ship were clothed by the builder, Capt. Chas. B. Dix, of the firm of McKay & Dix, in the graceful lines of our Maine-built coasting schooners.

Noticeable features of the "Roosevelt" are the pronounced rake of her stem, sharp wedge-form of the bows, a raking rudder-



THE "ROOSEVELT" AFLOAT, AT BUCKSPORT, MAINE, MARCH 23, 1905.

post, and generally rounded form of hull. At the same time the ship does not depart widely from recognized models, and, in addition to special fitness for her special work, it is hoped and believed that she will prove to be an able and seaworthy craft in the usual acceptance of the terms.

In the evening of the day of launching the "Roosevelt" started for Portland in tow of a tug, and the installation of the machinery began the following afternoon, at the works of the Portland Company. It is hoped that this installation will be completed and the ship go into commission in May.

During the thirteen-hour voyage, a portion of which was quite rough, with strong wind, the ship gave gratifying indications of easy propulsion, stability, and ready attention to the helm.

The "Roosevelt" is not the Peary ship, but the ship of the Peary Arctic Club—that organization of generous, public-spirited men who have contributed to her construction.

And while several members of the Club have contributed most generously, the fact that she is afloat and an actuality to-day is due entirely to the broad faith and courage of the President of the Club, Morris K. Jesup, who last summer, when the funds of the Club were insufficient to pay for the ship, personally assumed the responsibility, signed the contract, and guaranteed the payments.

Spurred by his splendid example, others have come forward, and the funds for the completion and equipment of the ship are assured. But funds for the current expenses of the expedition (some $30,000) have yet to be raised.

GEOGRAPHICAL RECORD.

AMERICAN GEOGRAPHICAL SOCIETY.

TRANSACTIONS OF THE SOCIETY, MARCH, 1905.—A Regular Meeting of the Society was held at Mendelssohn Hall, No. 119 West Fortieth Street, on Tuesday, March 28, 1905, at 8.30 o'clock P.M.

Vice-President Moore in the chair.

The following persons, recommended by the Council, were elected Fellows:

Linnæus Edford LaFetra.
Henry V. A. Parsell.
Henry A. Wise Wood.
Frank Klepetko.
John W. Wainwright.
Albert A. Wray.
Lewis Buckley Stillwell.
Charles Albert Whittier.
J. E. Bastin.
W. H. Rossington.
S. Zickel.
Joseph Wood.
Archibald Watt.
James Speyer.
H. P. Ulich.
H. O. Havemeyer, Jr.
Henry B. Spencer.
John Jay.
Sanford E. Cobb.
Fred E. Smith.
Charles H. Manning.
Frederick K. Mixer.
Francis J. McQueeney.
John E. Wilson.
J. S. Lemon.
Edwards Spencer.
Benjamin C. Williams.
Dillon Wallace.
Gustav L. Wilmerding.
Marshall S. Snow.
George E. Dimock.
John A. Just.
David H. Gaines.
Edgar S. Barney.
Robert Morris Pierce.
Edward Lindsey.
Charles Edwin Eaton.
Robert H. McCormick, Jr.
Louis Mohr.
C. M. Hobby.
Orlando Metcalf.
Dr. Eugene Murray-Aaron.
William D. Hoxie.
John Gilbert Ward.
Isaac Pitman Noyes.

The Chairman then introduced the speaker of the evening, Mr. Harlan I. Smith, who addressed the Society on Recent Archæological Discoveries in North Western America. Stereopticon views were shown.

On motion, the Society adjourned.

AMERICA.

THE GEOGRAPHICAL SOCIETY OF MINNESOTA.—American geographers will welcome the organization of this new Society, which has been formed in the hope of stimulating an interest in geography, especially among the teachers of Minnesota, so that they may study the subject more systematically and obtain better results in teaching it. Any student or teacher of geography in Minnesota may be elected a member. The Society was organized at the University of Minnesota, and Prof. C. W. Hall of the University was elected President, and Mr. Charles E. Flitner of St. Paul Secretary-Treasurer. The Society will have lectures, papers, and discussions under its auspices; arrange for field days and excursions, and make exchanges of

photographs, books, and illustrative material. At the first annual meeting of the Society, on December 27 last, Mr. E. V. Robinson read a paper on "The Panama Canal as a Factor in Industrial Geography"; Mr. F. W. Sanderson on "The Meeting Place of Geography and Geology"; and Mr. F. M. Ball of Minneapolis on "A New Method in Grade Geography." Each of the papers was discussed by the members. Ten cities of the State are thus far represented in the membership.

AGRICULTURAL EXPERIMENT STATIONS IN ALASKA.—Prof. C. C. Georgeson, of the Department of Agriculture, has established four agricultural experiment stations in Alaska, at Sitka, Kenai, on Kenai Peninsula, Copper Center, 105 miles from Valdez, at the head of Prince William Sound, and Rampart on the Yukon River. At each station, land has been cleared and put under cultivation. One by one the successes or failures are noted and reported. Prof. Georgeson has recently given much of his time to planting all kinds of hardy fruit trees and to experiments in budding and grafting currants, gooseberries, raspberries, etc. The results obtained at these stations should be carefully studied by all who think of following any branch of agriculture in Alaska. The report from the station at Rampart is more encouraging than the others. Mr. Reader, the agent in charge, reported that oats, rye, and wheat had matured, and were harvested about August 15, and that in ten days more the barley would be harvested.

COMPARATIVE AGE OF THE FLORISTIC ELEMENTS OF EASTERN NORTH AMERICA.—In a paper by Dr. John W. Harshberger (*Proceedings* of the Acad. of Nat. Sci., Philadelphia, Vol. LVI, Part 3, 1904), he presents the fact that the component elements of the flora of eastern North America have had an historical development, and gives the methods of determining their relative or comparative age and reasons underlying their distribution. After enunciating the general principles to be observed in scrutinizing the flora of the country, he applies them in the determination of the age of the floristic elements in eastern North America. Dr. Harshberger says in part:

> All of eastern America, north of the great terminal moraine which marks the southern boundary of the great ice-sheet, with the exception of the nunataks, has been tenanted by plants which have migrated into the territory abandoned by the great continental glacier. Geologists believe, from evidence afforded by the time that it has taken for the river to cut the gorge at Niagara, that 10,000 or 15,000 years have elapsed since the close of the glacial period. If their deductions are sound, then the flora of the northern part of eastern America cannot be older than 15,000 years at the outside. Some of its elements may be much older, and we have reason to believe that many boreal plants existed as such on the nunataks, which were unglaciated areas above the great ice-sheet.
>
> The first wave consisted of the distinctly glacial flora, which skirted the border of the ice-sheet. The second wave, younger as a floristic element of the North, consisted of boreal plants, many of which, as bog plants, tenanted the bogs and margins of the glacial lakes that were formerly much more abundant in the North than at present. These bog and tundra types pushed early into the barren ground left by the retreating ice.
>
> The tundra was closely followed by the coniferous forests on the western and eastern sides of the glaciated areas, and these trees constitute a third floristic element, much younger in point of the times in which they have occupied the North. These trees, and those forming a still younger element, surrounded the bog plant societies which were trapped by the surrounding tree vegetation; and as the bog was gradually transformed by biologic influences into firmer ground, gradually encroached on the bog plant associations. Present bog habitats are continuations of similar habitats which existed in early postglacial times, when tundra conditions and tundra vegetation were dominant. The fourth element just mentioned consisted of deciduous shrubs and trees—oaks, hickories, and the like—which at present are south of the great coniferous belt of forest. In the East, among the highlands, exceptional circumstances were afforded for the preservation of the northern forms.

During the glacial period, for example, Mount Washington was a nunatak tenanted by plants that have remained permanently on this mountain. The summit

flora is older than that of the lower Alpine slopes above timber-line, and the flora of these slopes is, in turn, older than that of such gorges as Tuckerman's Ravine, Huntingdon Ravine, and Great Gulf, which probably supported local glaciers for many centuries after the great ice-sheet had retreated from the Presidential Range.

CROPS IN THE SEMI-ARID REGION.—Under a somewhat sensational title, *Vast Hidden Wealth in the Semi-arid Region*, Mr. G. E. Mitchell, Secretary of the National Irrigation Association, points out, in *Forestry and Irrigation* for March, 1905, that the introduction of new drought-resisting crops and scientific methods of soil-culture are giving promise of good financial returns in portions of the United States which had been supposed to be worthless. Mr. F. V. Colville has recently pointed out that near Cheyenne, Wyoming, on a plateau 6,000 feet above sea-level, profitable crops can be grown on lands which have been regarded as suitable only for the sparse grazing of cattle and sheep. New plants brought from the semi-arid regions of Turkestan, Russia, and Siberia have been found to thrive under conditions which would cause the Mississippi Valley farm crops to die. Macaroni wheat is found to grow with 10 inches of rainfall a year and to yield 15 bushels to the acre where ordinary wheat is a failure. This macaroni wheat belt is stated by Mr. M. A. Carleton, cereal specialist of the Bureau of Plant Industry, to extend from north to south across the United States from the 98th to well beyond the 102d meridian. Other new crops which promise to be successful are kaffir corn, the sorghums, millets, and new drought-resisting varieties of oats and barleys. By improved methods of soil-culture, by sub-surface packing and continual surface cultivation, better crops can be obtained in districts of small annual rainfall than has hitherto been possible. The future is hopeful along these lines; but it must still be remembered that there is such a thing as a climatic desert, even within the borders of the United States.

R. DEC. W.

FIFTH REPORT OF THE GEOGRAPHIC BOARD OF CANADA.—This edition contains all the decisions of the Board to June 30, 1904. In a country where new geographic names are continually being introduced it is to the advantage of the Board's work that the Government of the Northwest Territories and each Province has the right to name one of its officials as a member of the Board to advise with regard to names in his part of the country. The decisions are given in alphabetical order, and also arranged by provinces and territories. Discarded names are printed in italics, with references to the names that have replaced them.

CANADA'S SECOND TRANSCONTINENTAL RAILROAD.—Vice-Consul-General George Hill writes from Halifax under date of Nov. 22, 1904, to the *Consular Reports* for January, 1905, that twenty-five separate parties of engineers were then at work on different sections of the Grand Trunk Pacific R.R., which is to cross New Brunswick *via* Edmunston, pass through Winnipeg, and reach the Pacific Ocean at Port Simpson, where it will connect with steamers for the Orient. Parliament last winter took the steps necessary to authorize the construction of this railroad, which will be 3,300 miles long.

AFRICA.

THE BRITISH ASSOCIATION MEETING IN SOUTH AFRICA.—According to a Johannesburg newspaper, two hundred or more members of the British Association are expected to visit that town when in South Africa for the autumn meeting. The Mayor of Johannesburg has estimated the consequent expenses at about £6,000. The guests are due at Johannesburg on August 28th. Sir David Gill reports that the various South African Governments have responded in a generous way to the call for

hospitality to the members—the Cape Government offering £3,000, the Transvaal and Orange River Colony £2,000, and Natal £1,000. The railways are also granting special arrangements, and, in some cases, free fares. Some five or six men of science are said to be going out ahead of the main body to study their special subjects in South Africa before the meeting.—(*Athenæum*, Feb'y 25.)

LAKE RUKWA FILLING AGAIN.—*Globus* (1905, No. 5, p. 84) says that Lake Rukwa, to the east of Lake Tanganyika, has risen within the past two years so that the water-level once more fills the whole area which travellers marked out as its recent bed. A number of Europeans, who visited the lake during the nineties, reported that it had shrunken greatly, and even in the height of the rainy season it did not appear to cover more than a part of its former bed. Missionaries Dromaux and Hamberger, who with Capt. Von Wangenheim, Chief of the District of Bismarckburg, report the recent rise of the waters, say that the lake now bathes again the site of Dr. Kayser's grave, near the north end of the depression it occupies. It is now possible to travel by boat from the mission station, some ten miles south of this spot, to that on the Songwe—a distance of nearly 100 miles.

The *Geographical Journal*, commenting on this interesting news, says that the facts show that caution is needed in adopting the conclusion that a rapid and progressive desiccation of Central Africa is now taking place, many instances of fluctuation of water-level being probably due to periodic variations of rainfall. It would be of interest to obtain information regarding recent changes of level in the other great African lakes.

THE UGANDA PROTECTORATE AND WHITE SETTLEMENT.—The fact that a large part of the Tropics must be developed by native labour, under the supervision of European overseers, is becoming more and more certain as the climatic conditions of one tropical possession, or "sphere of influence," after another are better known. Thus, in a recent Parliamentary paper (*Africa*, No. 12, 1904), the British Foreign Office has published a report by the Commissioner of the Uganda Protectorate, in which the following statements are made:

> I do not consider that Uganda will ever be a white man's country in the sense that South Africa is, and parts of East Africa will prove to be. The climate is not conducive to European colonization, nor to European manual labor in the open. The development of the Protectorate will be by native agency under European supervision, and with the help of European capital; and it is here that the opportunities for British enterprise come in . . . The work would be done by paid native labor under the superintendence of the settler and his assistants.

R. DEC. W.

COTTON-GROWING IN THE SUDAN AND IN NIGERIA.—The *Scottish Geographical Magazine* for January contains an abstract of a report on "Cotton-Growing in the Sudan," issued by the Sudan Government, and containing the results of experiments and investigations made during 1902–03. Cottons of various kinds and qualities have been grown in several districts with varying success. The Director of Agriculture reports that Dinka Land, an alluvial plain between the ironstone plateau and the sudd basin, comprises an area of about 14,000 square miles, at least half of which is suitable for cotton-growing. The serious difficulties at present in the way are the want of population and the heavy cost of transportation.

In a recent work, entitled "The White Man in Nigeria," the author, Mr. G. D. Hazledine, takes a rather optimistic view of the suitability of Nigeria for cotton-raising.

R. DEC. W.

THE ECONOMIC FUTURE OF AFRICA.—Dr. Karl Dove, Professor of Geography at the University of Jena, has a very interesting paper in the *Geographische Zeitschrift* (Vol. IX, No. 1) on the development of the African continent. It has at present

less than six inhabitants to the square kilometer. Dr. Dove estimates that the area of forest and arable lands capable of supporting a large population is 14,300,000 square kilometers; about 8,500,000 square kilometers of steppe land are capable of sustenance to a much less but still important number of human beings; and about 7,000,000 square kilometers are desert and useless lands. One square kilometer of forest and arable land he estimates as capable of supporting fifty persons, at which rate Africa should be able to support at least 700,000,000 of persons, which is about 500,000,000 more than the present population. The greater part of this vast area must always be the distinctive home of the native black tribes, for it is not adapted for occupancy by the white races. Prof. Dove estimates that only about 700,000 square kilometers in the north and 2,000,000 in the south are suitable for white colonization. Though gold is abundant and there are large supplies of iron, there is no evidence as yet that coal is anywhere present in great quantity, which is an industrial disadvantage. Only plants that can be cultivated by the natives themselves are likely to be of large future importance, and cotton is probably destined to be most valuable. The marked inferiority of Africa in natural means of communication will probably be the greatest obstacle in developing it. The development of a railroad system is positively necessary, because only three good waterways lead from the ocean into the interior, these being the Nile, the Niger-Benue system, and the Zambezi, with its Shire affluent toward Lake Nyassa. Only ninety miles of the lower Congo are available, but the network of railroads and navigation that is developing on the lower and upper Congo promises great results in the development of the interior. Natural harbours are poor and few in number. The length of the existing African railroads per 10,000 square kilometers of area is very small in comparison with the other continents, and Dr. Dove estimates that about 81,000 kilometers of new railroads are needed for the most advantageous development of the country.

He gives some interesting comparisons between the cost of freightage by the present methods of transportation in Africa and the cost on the Prussian State railroads. He shows, for example, that on the Southwest African railroad from Swakopmund to Windhoek the cost per ton is three times as much as on the Prussian railroads; the cost by ox-wagon in that part of Africa is nearly twenty times as much as on the Prussian roads, and the cost of carriage by porters is forty times as much. Thus, though the freight charges on the pioneer African railroads are very high, the development of railroad systems is necessary, because the cost of other methods of transportation would be prohibitive for a large amount of freight. There can, therefore, be little development without a large addition to the railroad mileage.

ORIGIN OF THE WITWATERSRAND GOLD.—The *Transactions* of the Geological Society of South Africa (Vol. 7, Part 3) contains an essay by Dr. F. H. Hatch and Dr. G. S. Corstorphine on the petrography of the Witwatersrand conglomerates, with special reference to the origin of the gold. The original explanation was that the Rand conglomerates were ancient placer-deposits, in which the gold was as much a product of denudation as the pebbles which accompany it. The authors show that the theory of the subsequent infiltration of the gold is most in accordance with the facts. The gold is practically confined to the matrix of the conglomerate, and occurs there in crystalline particles in association with other minerals of secondary origin.

NO ALCOHOLIC LIQUOR FOR NATIVES.—A liquor ordinance enacted for the British Central Africa Protectorate on the last day of 1904 provides that the distilled and alcoholic liquors may be admitted only for the use of the non-native population. No person may import such liquors into the Protectorate for the purpose of sale

without a license, and a duty of 12 shillings (about $3) per proof gallon will be imposed upon all distilled liquors and one of 10 per cent. *ad valorem* upon wines, beers, and other fermented alcoholic liquors imported for sale.

TURNING MANGROVE BARK TO ACCOUNT.—The *Board of Trade Journal* (No. 432) gives a brief account of the collection and shipment in the northern part of Mozambique of red mangrove bark for use in tanneries. The industry began about three years ago. The demand for the bark is increasing, and the industry is assuming an unforeseen importance. The valuable astringent properties of this commodity are attracting attention both in Europe and America, and the bark is beginning to be largely utilized. Extensive forests of mangrove are found throughout all the bays, estuaries, and river mouths of East and West Africa, where the trees grow thickly along the tropical coasts at all points accessible to tidal influence.

ASIA.

THE NEGRITOS OF ZAMBALES.—Mr. William Allan Reed, of the Ethnological Survey of the Philippines, during 1903, made a study of the Negritos of the Zambales Province in the southern part of the island of Luzon. His report, covering 90 pages, has been printed by the Government in Manila, and has just reached this country. The book includes an excellent index and a large number of photographic reproductions, showing these Negritos in their home life, industries, dances, and other aspects. One of the photographs shows a white soldier of average stature standing by the side of a mixed blood and a pure Negrito, the contrast graphically illustrating their diminutive stature.

The Negritos of the Philippines constitute one branch of the eastern division of the pygmy race. The western division is the African. It has been recognized that the blacks of short stature may be grouped into these two large divisions. Other well-known branches of the eastern group are the Mincopies of the Andaman Islands, and perhaps also the Papuans of New Guinea, who are similar in many particulars to the Negritos of the Philippines, although authorities differ in grouping the Papuans with the Negritos.

Mr. Reed's paper is chiefly concerned with Zambales, though Negritos are found, more or less mixed with other tribes, in at least eleven other provinces of Luzon. The dwarfs whom he studied lived in the mountainous portion of the lower half of Zambales and the contiguous provinces of Tárlac and Pampanga, extending southward to the extremity of the peninsula of Bataán. There is enough fertile land to support thousands of people, but the Negritos occupy practically none of it. Their villages and mountain farms are very scattered. They build their hamlets, for the most part, on the table-land above some stream, and their little clearings are found on the slope of the ridge at the base of which the streams run. No use is made of the grass-covered table-land.

They range in stature from 4 to 5 feet, and have kinky hair, almost black skin, and are not prognathous. Individuals sometimes attain the stature of the shortest of white men, and only a slight infusion of Malayan blood is necessary to cause the Negrito to equal the Malay in height.

The custom so prevalent in parts of Africa of sharpening the upper teeth prevails throughout the Negrito territory. The clothing of the male consists simply of a breechcloth and an occasional cast-off shirt obtained from some Filipino. A strip of cloth fastened around the waist and extending to the knees serves a woman for a dress.

The general condition of these natives, although not one of extreme misery, is

indeed pitiable. Their life is a continuous struggle for sufficient food, but their efforts to provide for themselves stop short at that; clothing and houses are of secondary importance. A shelter sufficient to turn the beating rains is all the Negrito asks. The most common hut consists simply of two-forked sticks driven into the ground, about four feet high and eight feet apart. A horizontal piece is laid in the two forks, then some strips of bamboo are inclined against this crosspiece, the other ends resting on the ground. Some cross-strips are tied to these bamboos, and the whole is covered with banana leaves. With the materials at hand, a half-hour is sufficient for one man to construct such a shelter. The more prosperous Negritos have four-posted houses of bamboo, with roof and sides of Cogon grass.

The Negrito knows little of the art of making things. His bows and arrows are fashioned with considerable skill, but his few other products are very crude and primitive.

The flint-and-steel method of fire-making has almost entirely supplanted the more primitive method by rubbing two sticks together; but in some instances this method is still followed, and everywhere the Negritos know of it. They borrowed the flint-and-steel idea from the Filipinos.

There is scarcely anything in the animal or vegetable kingdom of his environment of which the Negrito does not make use. He never has more than two meals a day, sometimes only one, and he will often start early in the morning on a deer hunt without having eaten anything, and will hunt till late in the afternoon. In addition to the fish, eels, and crayfish of the streams, the wild boar and wild chicken of the plain and woodland, he will eat iguanas and any bird he can catch, including crows, hawks, and vultures. Large pythons are especially desired, but these reptiles are very scarce. Besides rice, maize, camotes, and other cultivated vegetables there is not a wild tuber or fruit with which the Negrito stomach is not acquainted.

Chapters are given to the industrial life of the people, their amusements, a description of their social customs, and the futile attempts of the Spaniards to subject, convert, and organize the tribes. Appendices give a considerable number of anthropometrical measures, and four pages of vocabularies.

Live Stock in the Philippines.—The fifth annual report of the Philippine Commission says that the Government is now maintaining eight experiment stations and farms in the archipelago. Among the phases of experimentation that promise to be useful is the importation of breeding animals—cattle, horses, donkeys, hogs, and fowls which have been imported from the United States and distributed among several of the stations. Some of the best types of live stock in this country have been sent to these stations, and, on the whole, the animals have done very well. The milk supply of Manila is insufficient and unsatisfactory in quality, and it is hoped to establish a dairy farm in the suburbs of the city.

China's Foreign Trade in 1903.—The Annual Report of the Customs Department of China says that the value of the foreign trade of that Empire, expressed in the currency of the country, has again surpassed all previous records, reaching the high figure of 541,091,600 haikwan taels,* almost exactly double the figures of ten years ago. These data are a little misleading, however, the fact being that the actual quantity of trade was less than in 1902. This is explained by the circumstance that the prevailing prices were higher, and on the whole the quantities of goods bought and sold were somewhat smaller. The imports were valued at 326,739,133 haikwan taels. China paid 8,390,000 haikwan taels for 58,478 piculs† of

* The average value of the haikwan tael in 1903 was 61.3 cents.

† A picul equals about 133⅓ pounds avoirdupois.

opium, the price of this article of self-indulgence having increased to 750 haikwan taels a picul. Cotton manufactures, rice, kerosene, machinery, and coal were other important imports. The value of the exports was 214,352,467 haikwan taels. China's chief asset for meeting her international obligations is silk and its products, but in 1903 they constituted no more than 35 per cent. of the total exports. Tea showed larger increase than any of the other export products. Tonnage increased by 3,300,000 tons, the total being 57,290,389, of which Great Britain contributed 49 per cent., China 17, Japan 14, Germany 13, Norway and France each 2, and America and Russia each 1.

THE TEN CHIEF PORTS OF CHINA IN 1903.—The ports of China arranged in the order of the value of the importations and exportations tributary to them in 1903 is as follows: Shanghai, 285,443,000 haikwan taels; Canton, 68,205,000; Kaulun, 34,282,000; Tientsin, 21,703,000; Swatau, 18,895,000; Newchwang, 16,033,000; Amoy, 14,532,000; Chefu, 13,039,000; Hankow, 12,517,000; Fuchau, 11,345,000.

A VOCABULARY OF THE DIALECT OF BOKHARA.—In the second Danish–Pamir Expedition, conducted by Lieut. O. Olufsen, of the Danish Army, he improved the opportunity to make himself familiar with the language spoken in the regions he traversed. Most of the persons in his caravan were Sarts from Russian Turkestan, and one of his most trusted agents was Mirza Abdul-Khader Beg, from the town of Bokhara, who accompanied him by order of the Emir. This man, who was his most intimate associate, belongs to the most cultivated class of the Usbeg population of Central Asia. Lieut. Olufsen says that the Persian (Iranian) and Turkish nations of Bokhara and Turkestan are so intermingled that both in the larger and smaller towns they are seen living next door to one another. It is not rare that two merchants, neighbours in the bazaar of Bokhara, cannot understand one another, the one being a Tajik and speaking a Persian dialect, the other an Usbeg, speaking Turkish. The educated classes often speak both languages.

The vocabulary collected by the explorer covers 56 pages, and is chiefly derived from Mirza Abdul-Khader Beg and some of the words from his caravan people living in Osh, Turkestan. The equivalents of the words are given in English, and the vocabulary represents the language spoken in Bokhara and its environs. It is substantially identical with the Turkish language as spoken in Russian Turkestan by the so-called Sarts, a Turk from Bokhara conversing as easily with a Sart from Tashkent, Kokand, or Osh, as with one of his fellow-townsmen.

THE CLIMATE OF TIBET.—Before the Royal Geographical Society, on February 13 last, Sir Frank Younghusband gave an account of the geographical results of the Tibet Mission. The passage into Tibet, by the Tang-la Pass, 15,200 feet above sea-level, was attended with great suffering, on account of the low temperature (−18°) and the rarity of the air. The march over the elevated plateau, in the teeth of bitter winds and blizzards, was very difficult. These harsh conditions continued through January, February, and March. On arrival at Gyantse, April 11, the piercing cold was left behind; willows and poplars were bursting into foliage, and the river banks were covered with iris plants. Heavy rains fell on July 14, and frequent rain was noted until September, the size of the rivers showing that this part of Tibet receives a considerable rainfall, probably up the Brahmaputra Valley.—(*Nature*, February 16, 1905.) R. DEC. W.

THE BAGDAD RAILROAD.—The first section of the railroad that will connect Europe with Bagdad was opened on October 25 last, the birthday of the Sultan. It begins at Konia, in southwestern Anatolia, the terminus of the present line from

Constantinople, and extends eastward through Eregli to Bulghurlu. The rolling stock and railroad material were supplied by German and French manufacturers, and the Anatolia Railroad Company (German) is operating the section.

WIRELESS TELEGRAPHY.—Experiments have been made with wireless telegraphy between Diamond Island and the Andamans with the most satisfactory results. The *Pioneer Mail* says that a message recently transmitted from Port Blair, in the southern part of the Andamans, reached Calcutta in nineteen minutes, though it had to be transferred to the land-lines after reaching Diamond Island. The nearest point of the peninsula from Port Blair is 750 miles distant.

AUSTRALIA.

COTTON-GROWING POSSIBILITIES IN THE TROPICAL SECTION OF AUSTRALIA.—At a meeting of the Victorian Branch of the Royal Geographical Society of Australasia in Melbourne (*Victorian Geog. Jour.*, Vol. XXII, 1904) a paper was read by Dr. Thomatis, an Italian resident of Queensland, who has successfully experimented in the hybridization of different species of cotton. He has evolved a marketable type, which he has named *caravonica*. It is asserted that this cotton thrives in a moist, tropical country like Queensland, and promises to be very productive. The *Financier* of London says there is a fair prospect that the cultivation of this cotton will be undertaken on a large scale, not only in Queensland but through the whole tropical territory in the Commonwealth north of 18° S. Lat. The sole difficulty in the way is the restriction imposed on the immigration of coloured labour. It is said that, at the low rate of one-third of a bale to the acre, a total of 20,000,000 bales of the fibre may be produced in a year (!).

EUROPE.

THE WIDENING OF VIENNA.—On Dec. 28 last the city limits of Vienna were extended on the east by taking into the municipality an area on the left side of the Danube about half as large as the city and including a number of towns. With the exception of a very small territory the city has hitherto been confined to the right bank of the river. The added territory will form the twenty-first district of Vienna, with the name Floridsdorf. It includes 9,314 hectares, which will increase the area of the city to 27,126 hectares. This makes Vienna now the largest city of continental Europe, and it is surpassed only by Greater London, with its area of 30,218 hectares. The result of the union is not so important in its addition to the population of the city, as it adds only 61,536 persons. The city in its new extent had, on Dec. 31, a total population of 1,878,339, being still surpassed by London, Paris, and Berlin in number of inhabitants. The *Deutsche Rundschau für Geog. u. Stat.* (Vol. 27, No. 6), from which these facts are taken, has a map of the city in its new extent on a scale of 1:75,000, or 1.18 statute miles to an inch.

THE SIMPLON TUNNEL.—The north and south galleries of the Simplon Tunnel between Switzerland and Italy were joined on Feb. 24. The two galleries met in the middle of the Alps, at a point 6 miles and 791 yards from the north entrance. The length of the tunnel is 19,803 metres, or about 12.26 miles, and it is the longest in the world. The length of the Arlberg Tunnel is 6.36 miles; Mont Cénis, 7.98; St. Gothard, 9.3 miles; Severn, 4.35 miles, so that the Simplon exceeds the next longest by nearly three miles. The great difficulty of piercing this tunnel was not its length but the soft and, consequently, treacherous rocks found in places, combined with hot and cold springs of great volume, the former being of high temperature. The work

now remaining is to put into place the masonry arching to cover over the water channel beneath the floor of the tunnel and to lay the permanent way, after which the formal inauguration will doubtless take place, with general rejoicings upon the completion of the most remarkable work of its kind in the world.

AUTUMN RAINFALL AND THE YIELD OF WHEAT IN ENGLAND.—In the London *Times*, Feb. 7, 1905, Dr. W. N. Shaw, F.R.S., called attention to a relation between the autumn rainfall and the subsequent yield of wheat which is remarkable. "Autumn" is a season of thirteen weeks, covering approximately the months of September, October, and November, and the figures for the yield of wheat express in bushels per acre the average yield for England as given in the returns of the Board of Agriculture. With certain exceptions it is seen that "every inch of autumn rainfall involves a diminution of the yield of wheat for the following year by a bushel and a quarter per acre." Seven years out of the 21 considered give an agreement within a half bushel, when the yield is computed from the autumn rainfall by subtracting from the datum of 39.5 bushels per acre one and a quarter bushels for every inch of autumn rainfall. Among the reasons given for the influence of the autumn rainfall upon the wheat yield are the washing of nitrates from the soil, and the postponement of sowing to the spring because of the moisture; but, still, the close relation remains a very remarkable fact. The study is based on averages over large areas, and the conclusions might have to be modified if separate districts were considered. Dr. Shaw read a paper on this subject before the Royal Society on Feb. 2, 1905 (*Nature*, Mar. 16), and the *Times*' letter is reprinted in *Symons' Meteorological Magazine* for February.

R. DE C. W.

ENGLISH FOGS AND COMMERCE.—All are more or less familiar with the geographic fact that England, and the English cities, have dense fogs. But few realize their commercial significance. U. S. Consul Mahin, stationed at Nottingham, gives us a number of interesting items, some new and some familiar to students, concerning such phenomena. The fog becomes most dense after sundown, often gradually melting away toward midday, but occasionally continuing all day. A very thick fog rarely lasts more than two or three days. The first ones come with the autumn frosts, corresponding in time and atmospheric conditions with our Indian summer. The air is very still and the temperature relatively low. Densest fogs are usually in November, but the maximum number of foggy days is in December, then November, January, and October. The average annual number of such days in London is 55—45 from October to March. Clearest months are May–July. Least stormy years are freest; cold and quiet years have most.

It is stated by many authorities that the fog is much aided in formation, as well as intensified, by the presence of dust particles, as those of smoke. Coincident with this comes the statement that the fogs are thinnest and rarest in the months when coal is burned least. It has been pointed out that they increased as the use of coal grew, and that during the last fifteen or twenty years they have become less dense, owing to the more extensive use of electricity and to systematic attempts to abate the smoke nuisance. Hence it appears that they are related to the great industrial development of the cities, and belong more especially to the purely coal-using stage in that evolution.

They seriously interrupt business of all kinds—delay passengers, increase risk, increase help needed, and expense of precautionary measures. Extra labour is employed, and even the pay of engineers and firemen is increased during fog days. Detention of goods and delay in delivery cause loss which often falls on the railroad companies. The moisture damages store goods and furniture, furs and textiles. The

death-rate increases and throat and lung troubles are aggravated. The author mentions some discussions and suggestions of means to disperse or partially dissipate fog. —(*Consular Report* for February, 1905, p. 10.) G. D. H.

DOCKYARD AT DEVONPORT.—Rapid recent development and contemplated immediate improvements of this river-mouth harbour of southwestern England not only make Devonport the first naval port of the Kingdom, but will put her in possession of one of the largest docks and dock basins in the world. A sea-wall now stretching from the southern end of the yard will be extended; abundant facilities for coaling all kinds of vessels, and dredging, to increase the depth to a 30 feet high-tide level, are already under way. A mammoth electric power plant at Keyham will furnish power and light for the entire governmental and other establishments.—(*Consular Report*, February, 1905, p. 66.) G. D. H.

THE VERTICAL GRADIENT OF RAINFALL AT BEN NEVIS AND THE PUY-DE-DÔME.—At the meeting of the Scottish Meteorological Society, held in Edinburgh, December 6, 1904, Mr. A. Watt discussed the question of the vertical gradient of rainfall. The 19 years' series of rainfall records from the Ben Nevis Observatories showed, somewhat unexpectedly, that the ratio of the amount of rainfall at the top of the mountain to that at the foot exhibited very little variation from month to month. On the other hand, comparing the rainfall on the Puy-de-Dôme with that at its base station, Clermont, for an 18 years' period, there is a radically different curve, the two sets of monthly ratios being as follows:

	J.	F.	M.	A.	M.	JU.	JY.	A.	S.	O.	N.	D.
Ben Nevis, Fort William.....	1.9	1.9	2.3	2.2	2.3	2.2	2.3	2.2.	2.1	2.0	2.0	1.9
Puy-de-Dôme, Clermont.....	5.5	4.5	4.2	2.8	1.8	1.6	1.7	1.8.	1.8	2.3	2.9	4.6

The two Scottish stations had much heavier rainfalls than the two French ones, and only the general character and not the amplitude of the two curves was in consideration, especially since differences of height might affect the problem. The differences of the curves may be accounted for on the following suppositions: (1) That the greater part of the Ben Nevis rainfall is of cyclonic origin, since there does not seem to be any theoretical reason why the gradient of rainfall of purely cyclonic origin in a mountainous district should have a seasonal variation; (2) That a great part of the Central France rainfall is of local convectional origin. The zone of maximum rainfall of such origin varies greatly in height with the seasons, as explained by Hann and others, and would certainly be far above the level of the Puy-de-Dôme in summer, and probably below that level in winter. But all rainfall problems are complex, especially those dealing with high levels, since the mass of a mountain has a double influence, in deflecting winds upwards, and in causing or strengthening local convectional currents in warm weather. R. DEC. W.

GLACIAL FEATURE IN THE SURFACE OF THE ALPS.—Under this title Prof. Albrecht Penck, of the University of Vienna, has published (*Journ. Geol.*, 1905, Vol. XIII, pp. 1–19) an exceedingly scholarly statement of the extreme view of glacial erosion, of which he is one of the most distinguished advocates. He points out that in numerous ways the Alpine valleys differ from normal stream valleys. Instead of a regular curve the upper valleys descend by steps, and lower down there is often a reversed slope, holding a lake. These are features which streams destroy, instead of produce. The mouths of the tributaries are usually not accordant with the main valleys, but are at a higher level, forming hanging valleys, at the ends of which there are gorges and often strikingly-developed waterfalls. On each side of

the main valley walls are commonly found well-marked ledges or shoulders separating two quite different slopes, a more gentle one above and a steeper slope below, bounding a trough-like lower valley. The appearance is that of a newer valley, excavated in the bottom of an older one, whose level is indicated by the shoulder and by the elevation of the hanging tributary valleys.

That the features are not due to subsidence is indicated, in the case of the lake valleys, by the fact that the lake water does not enter into the side valleys, proving digitation, but, on the contrary, the side-valley bottoms are above lake-level. The valley-forms are so unlike those of normal streams that Penck considers it impossible that they can be river-formed. This conclusion is based upon the fact that the valleys have the width of mature valleys, but bottom slopes, steep sides, and discordant tributaries, which are wholly out of harmony with maturity of valley-form.

That these features are the result of ice erosion is the main thesis of the paper, and the case for ice erosion is very clearly and forcibly stated. Beginning with the elimination of other explanations, Penck then points out that the conditions above outlined are found only within the region visited by ice of the Great Ice Age. He then considers the question of how ice erodes, and why it erodes faster in some places than in others, and follows this with a consideration of specific instances of ice-eroded valleys and passes.

Altogether this is the most masterful discussion of ice erosion in the English language that has come under notice of the reviewer; but it is only an abstract of a much more detailed discussion by Penck and Brückner, under the title of *Die Alpen im Eiszeitalter* (Leipzig). The extent to which ice erosion is appealed to as a factor in modifying topography is startling, exceeding as it does even the claims of ice erosionists in the days of Ramsay. The following quotations will suffice to show how far Penck goes in the application of ice erosion to the shaping of topography in glaciated regions:

> The increase of destruction above the glacial snow-line is not due to an increase of weathering above it, but is caused by the development of a new agency, degrading land at a faster rate than the running water. This agency is the glacier ice.

On the next page (19) Penck says:

> The actual surface features of the Alps do not at all correspond to those of a water-worn mountain range. Their conformation is mostly due to ice-action, which becomes most visible where the old glaciation ceased.

For the present, at least, it is doubtful if many students of physiography will go quite as far as this; and it should be stated that there is still a large body of students of glacial action who deny to ice even a small share in shaping topography.

R. S. T.

Survey of Iceland.—According to *Petermanns Mitteilungen*, the Danish Government began the survey of Iceland as soon as that of the Faroes was completed. Much of Iceland has never been accurately surveyed, triangulation having been carried out in only a few parts of the island. The least-known region is the southern coast, which is impassable in summer owing to the quicksands; and also the inland ice-masses of the Vatna Jökull, and it is here that a beginning has been made with the survey. During the summer of 1903 a plan of the survey was laid down by means of a preliminary expedition; and in the spring of 1904, so long as the frosts made it possible to cross the morasses and streams, a part of the southern region in the district of Skeideraasande was surveyed. A second survey party was detailed to study the inland ice. One result of the work was to show that the highest point of the island is Hvannadalshnukr, which is 2,120 metres, and not, as has been hitherto

supposed, the Oraefa Jökull, which is only 1,959 metres. In all about 100 Danish square miles—that is, 5,700 kilometers—have been already surveyed.—(*Scot. Geog. Mag.*, March, 1905.)

POLAR.

THE ZIEGLER ARCTIC EXPEDITIONS.—In January of this year Mr. William Ziegler purchased from the British Government the whaler *Terra Nova*, for the purpose of heading a Relief Expedition to Franz Josef Land in search of members of the Ziegler Polar Expedition, who left Norway July, 1903, on board the S.S. *America*.

The *Terra Nova* will be commanded by William S. Champ, who has selected for his captain Captain J. Kjeldsen, with a Norwegian crew. A small party will accompany Mr. Champ, comprised of medical men, in all a party of probably four or five members. This expedition will be thoroughly equipped to over-winter, if necessary, arrangements having been made to take on dogs for field work.

In addition to the voyage of the *Terra Nova* the S.S. *Belgica* has been chartered for the purpose of visiting Shannon Island and Bass Rock on the east coast of Greenland, between 75 and 76 degrees of latitude, where relief depots were laid down in 1901. The object of this voyage is to ascertain if, by any chance, any of the members of the previous expedition have returned by the way of the east coast of Greenland.

This expedition will leave Norway on the 15th of May, and the personal representative of the expedition will be Dr. Oliver L. Fassig, who has been nominated for this purpose by the National Geographic Society of Washington.

The *Terra Nova* is being thoroughly overhauled, and will be commissioned and ready for sea the first week of May, sailing from London to Cardiff for coals and then direct to Tromsoe, Norway, where additional equipments will be taken aboard and the start direct for Franz Josef Land will be made about the last week in May or first of June.

THE CHARCOT ANTARCTIC EXPEDITION SAFE.—After the anxiety created by the failure of an Argentine vessel to find any traces of the French Antarctic Expedition in a region which it expected to visit, it is gratifying to receive news from Mr. Jean Charcot, the explorer in command, announcing that his party is well and has made valuable discoveries. In a letter written at Puerto Madrin, on the coast of Patagonia, and dated March 4, the explorer says that scientific work was carried on under excellent conditions while wintering on Wandel (?) Island. Several parts of Grahamland, hitherto unknown, were explored by the expedition, and its outline was determined by following its coast.

FATE OF BARON TOLL.—According to a Reuter dispatch from St. Petersburg, dated March 9, the North Polar Commission has officially declared that the expedition under Baron Toll to the new Siberian Islands, in the Arctic Ocean, has ended with the death of all the members of the party. The party sent in search of the expedition found in Bennett Island a letter written by Baron Toll, saying that the members of the expedition had continued on their journey though having only 18 or 20 days' provisions left. It is, therefore, believed that Baron Toll and his companions perished of hunger.

THE SOUTH POLAR TIMES.—During the Antarctic winter of 1902 and 1903 the officers of the British National Antarctic Expedition on board the *Discovery*, among the other diversions for lightening the long and dreary darkness, brought out at monthly intervals a paper, to which they gave the name of *The South Polar Times*. Specimen pages have been sent to this Society; and it is not too much to say that in

literary quality, in variety, and especially in artistic features, no enterprise of the sort (for earlier polar expeditions have made similar ventures) has equalled this publication. Its letterpress, which was typewritten, ranges over a wide field, grave and gay, scientific and humorous, prose and poetry; and includes many contributions, not only by the officers and scientific staff, but also by the men. Among the contents are a diary of the events of each month, a record of the proceedings of the local debating society, stories, humorous notes, and articles of a more solid nature.

Its most striking feature, however, is the numerous artistic pictures, both in colour and in black-and-white. They include coloured sketches of the animal life, and many bits hitting off the sledging, the sports, and other incidents of the sojourn of the Expedition. It is intended to reproduce the eight volumes of this unique production in facsimile, if sufficient subscribers are obtained for the work to cover the expense. The publication will have about 400 quarto pages, and the price has been fixed at five guineas. Subscriptions may be sent to "The Secretary, *South Polar Times*, 1, Savile Row, London, W."

VARIOUS.

Drift of a Bottle in the Atlantic.—A bottle thrown overboard in Lat. 29° 30′ N., Long. 68° 10′ W., by Col. Swalm, U. S. Consul at Southampton, England, in May, 1903, has just been found on the Donegal coast, Ireland, near Arranmore. The bottle had apparently been carried by the Gulf Stream and drift along the North American coast, then across the Atlantic to the Irish coast. To travel this distance it had taken 662 days, at an approximate speed of 5 miles a day.

Germany's Colonies.—The British Foreign Office *Report* on the German Colonies for 1902–3 calls attention to the Imperial Chancellor's memorandum, December, 1903, which says that the colonies are advancing too slowly, though their progress is unmistakable. The labour problem has been serious in Samoa, as well as in German East Africa and the Cameroons, though the situation has been relieved in Samoa by the importation of Chinese coolies. The war with the natives in German Southwest Africa bids fair to cost the Imperial treasury at least $12,500,000, and the situation there causes much anxiety. The white population in German South-West Africa on January 1, 1903, was 4,682—an increase of only 8 in a year. The railroad between Swakopmund and Windhoek was operated during the year at a loss of $112,000. The track and railroad have since been badly damaged by the hostile natives, and $150,000 have been voted for repairs.

The total imports and exports of the German colonies in the fiscal year 1902–3 amounted to $15,700,000—an increase of $1,720,000 as compared with the previous year. The imports in four years have risen only 30 per cent., while the exports have increased 55 per cent. Since Kiao-chau was occupied by the Germans it has cost the treasury $3,060,000 a year, or as much as all the other German colonies together; but, by way of compensation, its advance has been most remarkable. The trade of Kiao-chau in 1902–3 was double that of the previous year; and to the German occupation are due the excellent inner harbour, the large quarter filled with European villas and two Chinese towns.

Great Canals of the World.—Information concerning the great ship canals and other canal systems of the world can be found in the Monthly Summary of Commerce and Finance for January, 1905. This publication is prepared by the Bureau of Statistics, Department of Commerce and Labor, Washington, D. C., and can be obtained as a separate.

Among the great canals the oldest, the Suez Canal, dating from 1869, and the

double canal, the United States and Canadian, connecting Lakes Superior and Huron, may be mentioned. The American canal is used by more ships annually than the Suez, and the volume of trade is far greater. Other canals discussed are the Cronstadt and St. Petersburg, the Corinth, the Manchester, the Kaiser Wilhelm, the Elbe and Trave, the Chicago Sanitary Canal, and many minor waterways designed to overcome geographic obstacles or take advantage of geographic aids. Projected canals in Prussia and Canada are discussed. The value and future of China's canals, and the history, construction, and probable influence on international commerce of the American Isthmian canal form instructive sections. The section of the paper devoted to the economic effects of ship-canals treats of their significance in commerce, industry, business methods, and the producing and marketing of commodities. In this study canals are classified as single-port canals, such as the Manchester and Amsterdam waterways; minor connecting canals, as the Corinth, Kiel, and Welland; and major connecting canals, as the Suez, St. Mary's Falls, and the Isthmian. The author shows that the port canals have a marked developmental influence on the commerce of the cities which they serve; that the minor canals do not cause very great changes in the commerce of places connected, although they do divert some trade from former routes; and that the major canals are of enormous consequence, not only in diverting trade from old routes but in developing new trade.

Special discussion of the Suez Canal shows its influence in the commerce of rice, wheat, and petroleum, in the total commerce carried on in the Mediterranean, and in the change from sailing to steam vessels in Oriental trade. The discussion of the "Soo" (Sault Sainte Marie) Canals shows their relation to the enormous development of the Lake trade, to the iron industry, to the rise of the Lake Superior iron mines and decline of the Pennsylvania output, and to the production of wheat in the Northwest, as well as several effects on prices of various commodities. The discussion of the Isthmian Canal is largely prophetic, and mentions many industrial and commercial changes which may be expected.

The article continues with a special treatment of the canals and canalized rivers of a number of the European countries, and closes with summaries of the traffic of six of the leading canal systems of the world, including those of New York State.

G. D. H.

Subterranean Temperature.—The Carnegie Institution has recently granted to Dr. G. K. Gilbert the sum of $1,000 for preliminary work in preparing plans for an investigation of subterranean temperatures by means of a deep boring. In the Year Book of the Carnegie Institution (Nov. 3, 1904, pp. 259–267), Dr. Gilbert has made his preliminary report, and has recommended the appropriation of $65,000 for this work. Hitherto our knowledge of earth temperature has been derived mainly from mines and well borings, in both of which conditions are such as to lead to the introduction of influences which must modify the normal temperature gradient. By Dr. Gilbert's proposition a site in the granite area of the Lithonia District of Georgia is selected, in which there seems to be a probability of very uniform and normal conditions. Here the rock, which is granite, promises to be uniform in character, continuous, massive, and impervious. The region selected is one of low relief, which has not received heavy deposit during later geologic periods, and which has not suffered recent geological changes, such as glaciation, vulcanism, or rock disturbance, liable to modify the normal gradient of underground temperature. Altogether the site is favourable for the investigation, which promises to give information of high value to students of earth science; and it is an investigation which, without

the aid of some such fund as that of the Carnegie Institution, could not, in all probability, be undertaken because of the expense involved and the absence of possibility of financial return. R. S. T.

MINERAL MATTER IN THE SEA.—In a recent number of the Scottish Geographical Magazine (Vol. XXI, No. 3, March 1905, pp. 132,136), Prof. R. D. Salisbury presents some interesting figures on the amount of mineral matter in the sea. Assuming the average depth of the sea to be 12,456 feet, the amount of mineral matter dissolved in the ocean water would, if precipitated, cover the entire ocean floor to a depth of about 175 feet. It would make a layer of from 414 to 450 feet over all the lands, or 125 feet over the entire surface of the earth. The mineral matter in solution in the ocean water is equal to nearly one-fifth the bulk of all the lands above sea level; it is equal to all of North America, Europe, Australia, and most of the islands of the world, or, in other words, to all the land above sea-level except Asia, Africa, South America, Antarctica, and Greenland.

If deposited near the margins of the continents this mineral matter would fill the ocean from the borders of the lands out to a depth of about 4,000 feet—that is, over an area of at least 19,000,000 square miles. There would thus be added to the lands an area equal to one-third of the existing lands, or an area equal to that of North America, South America, Europe, and the East Indies combined.

These figures, while showing the enormous amount of matter in solution, do not do more than give a hint as to the real importance of the solvent work of water, for it is, of course, true that the mineral matter is now and for ages has been extracted from the sea-water for deposit in rock beds on the sea-floor. Salisbury makes the statement that the amount thus extracted has far exceeded all that remains in solution. He reaches this conclusion by two distinct lines of argument. In the first place, most of the limestone, the gypsum, the salt, and probably much of the cementing materials of sedimentary rocks, have been derived by extraction from solution in sea-water.

There are no exact figures as to the average thickness of such rocks even on the land; but it is certainly several hundred feet, and Dana has estimated it at 1,000 feet for the lands. It probably far exceeds 450 feet, the average depth to which the mineral matter now in solution in the sea would cover the lands. It is true, furthermore, that the soluble substances have been re-dissolved, re-extracted, and redeposited, in some instances repeatedly.

The same conclusion of former great deposits is reached by Salisbury in a second way. River-water contains about twenty times as much calcium carbonate as salt, but sea water has only about $\frac{1}{2\frac{1}{2}5}$ as much. This indicates that enormous quantities of calcium have been extracted. The same conclusion is reached by comparing other substances, such as magnesium carbonate, silica, etc., in river and sea water.

The bearing of these facts on an interpretation of geological processes is important and significant. The growth of deltas, the movements of sand along the coast, and the filling of bays and harbours are familiar facts, because they can be seen; but this invisible work of running water, and these enormous supplies of mineral matter in solution, and their importance in interpretation of past changes, are not so universally understood and appreciated. R. S. T.

IN HONOUR OF DR. ANDREE.—The issue of *Globus*, No. 7, 1905, is dedicated to Prof. Dr. Richard Andree in honour of his seventieth birthday, which occurred on Feb. 26 last. The literary activity of Dr. Andree has extended over forty-five years, during which his contributions to geographic science have been very numerous. In 1881 appeared "Richard Andrees Allgemeiner Handatlas," which first supplied to

Germany a thoroughly good and cheap atlas. Hundreds of thousand of copies have been sold.

THE GERMAN GEOGRAPHICAL CONGRESS.—The fifteenth German Geographentag will be held at Danzig on June 13–15. Among the subjects of papers and discussions will be south polar exploration, vulcanology, coast morphology, and formations of dunes and school geography.

LONG-RANGE WEATHER FORECASTS.—There has always been a fascination about long-range forecasts of weather, and the investigations which have been made along various lines in this connection run well into the hundreds. From very early times, doubtless, there have been predictions of coming weather by seasons, the behaviour, or the condition of the fur or other covering of animals being taken as an indication of severe or mild winters. Predictions of this sort find their way into our papers every year, one of the most common of these being based upon the quantity of nuts stored up by squirrels. Obviously, the behaviour of animals depends upon their physical condition, and the quantity of nuts laid away depends somewhat upon the abundance of the nut crop, and all these things are related to *past* weather, not to the *future*. Many so-called weather prophets have evolved elaborate systems of predictions based upon astronomical conditions, real or hypothetical; but where these conditions have been thoroughly investigated the whole fabric has fallen to pieces, either because the astronomical or physical facts were not sound or because the predictions were too general to be possible of verification. Studies of the relation of weather phenomena and the sun spot periods have been numerous, but have given somewhat contradictory results. Supposed lunar influences have always held attention, and many investigations along this line have thus far failed to bring us to any general, definite results which could be of any value in forecasting. Therefore, thus far, the best that can be done, in a practical way, as regards regular weather forecasts, is limited to predictions for a day or two, and occasionally three or four days, in advance. Nevertheless, weather "prophets" still flourish in different parts of the world, and even sell their misleading predictions at a good price. In order to counteract, in some way, the influence of these "quacks," the Weather Bureau has issued a *Bulletin* (No. 35, 1904) on *Long-Range Weather Forecasts*, in which the general subject of reliable and unreliable weather predictions is discussed.

R. DEC. W.

OBITUARY.—M. Charles Gauthiot, the founder of the Société de Géographie Commerciale, of Paris, and its Perpetual Secretary, died on the 27th of February last of a painful malady, endured for many years with serene stoicism.

A man of indefatigable energy and activity, M. Gauthiot possessed gifts of character and intellect which made a lasting impression upon every one brought within the range of his influence, and his death is felt as a personal loss in many countries.

NEW MAPS.

AFRICA.

ABYSSINIA.—Sketch map showing the routes of W. N. McMillan's expedition, 1904. By B. H. Jessen. Scale, 1:1,000,000, or 15.78 statute miles to an inch. *Geog. Jour.*, Feb., 1905, London.

The route crossed, from north to south, the upper portions of the rivers which form the Sobat. This region is in southwestern Abyssinia. The journey extended about 140 miles from N. to S., the southern 90 miles being practically unexplored. The map contains considerable new data relating to the upper part of the Sobat basin. Hill features along the route are indicated, and the scale permits many notes on the floral and hydrographic aspects of the country. The map is from a prismatic compass survey, and is adjusted to the longitude of Taufikia, on the White Nile.

GERMAN EAST AFRICA.—Karte von Deutsch-Ostafrika (Sheet F 4 Gawiro). By M. Moisel. Scale, 1:300,000, or 4.73 statute miles to an inch. *Mitt. aus den deutsch. Schutzgeb.* Vol. 18, No. 1, 1905. Berlin.

The 21st sheet of this official map to appear. The whole map will contain 29 sheets, and 4 of the 8 yet to be published are now being prepared. The sheet covers the part of German East Africa between 8° 30′–10° S. Lat. and 34°–36° E. Long., lying to the N.E. and E. of Lake Nyassa. It is an excellent specimen of cartography, based upon a large amount of original material. It illustrates the remarkable progress the Germans are making in the more minute study of this part of Africa. Seven years ago the only information upon which a map of this region could have been based was the route maps of Joseph Thomson (1879), Steward (1880), Giraud (1883), Johnston (1889), Wissmann, and Dr. Bumiller (1893). Their reports and maps were very important as the first information concerning a new region, but, on account of an unavoidable roughness of execution and paucity of details, they were not of the highest value, and their interest is now chiefly historical.

Seven years later the present map is the result of 63 surveys large and small, and a series of sketches of plans, the work of 29 travellers. The 63 surveys include about 650 sheets of mother maps on scales of a half mile to a little over a mile to an inch. All the surveys were made by officers in the German East African service, and the work has been done without expense to the State, excepting for the necessary instruments. The present sheet is based upon the exact determination of the geographic co-ordinates of 137 different points, and it gives a clear idea of the orographic and hydrographic conditions in this comparatively elevated region. Scattered through it are considerable areas that are not yet studied in detail; but, on the whole, this portion of German East Africa is now one of the best-mapped parts of the tropical area. This sheet will be all the more serviceable because the region it represents, together with that shown in sheet "Iringa" adjoining it to the N. (already published), is believed to present special advantages for white colonization.

UGANDA.—Ripon Falls. Scale, 1:6,000, or 500 feet to an inch. Survey Department, Cairo, 1904.

A plan of the outlet of Victoria Nyanza. A broad channel leads out of the lake for about 1,000 feet, where it suddenly narrows between two promontories, and the water pours over Ripon Falls in three channels, which are parted from one another

by rocky ridges. There the Nile begins. The main volume of water passes over the falls by the western opening. The actual drop over Ripon Falls is five metres (about 18.3 feet). Illustrates Sir William Garstin's *Report* upon the Basin of the Upper Nile.

UGANDA.—Sketch map of part of Unyoro. From a route-traverse by Capt. R. C. R. Owen. Scale, 1:500,000, or 7.9 statute miles to an inch. *Geog. Jour.*, March, 1905.

The routes of Capt. Owen extended through the region between the Albert Nyanza on the west and the Victoria Nile on the east and north. Distances were measured by pacing and the route-traverse was carried out with prismatic compass. A mass of *sudd* is shown at the entrance of the Victoria Nile into the Albert Nyanza.

AMERICA.

UNITED STATES.—Geologic Atlas of the United States.

No. 118. Greeneville Folio. Tennessee–North Carolina. Area, 963 square miles. Between parallels 36°–36° 30′ N. Lat. and meridians 82° 30′–83° W. Long. Two of the chief divisions of the Appalachian Province are represented in this quadrangle. The Appalachian Mountains occupy about 100 square miles in the southeast part of it, and the remainder lies in the Great Valley. Tributaries of the Tennessee River drain the region. Scale, 1:125,000, or 1.9 statute miles to an inch. Contour interval, 100 feet.

No. 117. Casselton–Fargo Folio. North Dakota–Minnesota. Area, about 1,640 square miles. Between parallels 46° 30′–47° N. Lat. and meridians 96° 30′–97° 30′ W. Long. Fargo (population, about 10,000), the largest city of North Dakota and the centre of trade for the Red River Valley, is in the eastern part of the area. This region shows a typical section across the valley of the Red River, including a small extent of prairie upland on the west. It also includes the eastern margin of the Cretaceous artesian basin, where the water-bearing formations rise to within 200–300 feet of the surface, and are most easily studied through the deep wells. Within this area also are found the water horizons, yielding only tubular or dug wells, that are the only source of water supply over a large part of eastern North Dakota and western Minnesota. The entire region is so flat that, even with a contour interval of only 20 feet, few contours appear except along the uplands of the west and south.

UNITED STATES.—Map of Washington showing Mean Total Precipitation. By Henry Landes. Scale, 47 statute miles to an inch. U. S. Geological Survey, Washington, 1905.

Illustrates a preliminary report on the underground waters of Washington (Water-Supply and Irrigation Paper, No. 111). Isohyetal curves show the amount of annual precipitation in all parts of the State, and the contrasts between one part and another may be seen at a glance. The rate of precipitation steadily declines from the extreme west, where the curves show annual rainfall of from 100 to 85 inches, to about the 120th meridian, where it ranges from 10 to 15 inches, and then increases to 20–25 inches in the eastern tier of counties.

UNITED STATES.—Forest Density and Land Classification, Northern New Hampshire. Scale, 5½ statute miles to an inch. Bureau of Forestry, Bulletin No. 55, U. S. Department of Agriculture, Washington, 1905.

Illustrates a monograph by Alfred K. Chittenden on Forest Conditions of Northern New Hampshire. The map includes the entire White Mountain region.

Ten tints show the estimated amount of lumber-yield per acre for the hard and soft woods, the agricultural lands (which are chiefly confined to the river valleys), the burns (small streams), and the waste and barren lands. Contours of elevation are introduced from the Government topographic sheets.

PERU.—Provincia de Cajabamba. Scale, 1:500,000, or 7.8 statute miles to an inch. *Boletín* del Cuerpo de Ingenieros de Minas del Perú, No. 19, 1905. Lima.

Shows all the mining enterprises of the province, and distinguishes the coal from the metal-producing mines.

ASIA.

DUTCH EAST INDIES.—Overzichtskaart van Java en Madoera (8 sheets). Scale, 1:500,000, or 7.8 statute miles to an inch. Topographic Bureau, Batavia, 1905. (Price, 8 guilders.)

An admirable product on a scale sufficiently large to show most information that is commonly presented cartographically. Marshes, plains, and hill regions are differentiated, wagon roads, footpaths, railroads, lighthouses, anchorages in the roadsteads, and reefs and rocks alongshore are among the kinds of information given. Heights are in metres, and place-marks indicate the political status of each town, as the capital of a residency, district, etc.

Mountains are shown in wash colours with considerable effect. Five cable lines start from the east end of Java for various points. The meridian of Batavia is used, which makes the maps less convenient for general use than might be desired.

DUTCH EAST INDIES.—Overzichtskaart van Atjeh en Onderhoorigheden (16 sheets). Scale, 1:2,000,000, or 31.56 statute miles to an inch. Topographic Bureau, Batavia, 1903.

The scale shows clearly the small areas which have been topographically surveyed, the levels being denoted by contours with 25-metre intervals. Most of the region, however, is practically white, and the information given would have been just as intelligible on a smaller scale. The special purpose of the map is to show administrative districts and their subdivisions for the use of the Government staff.

WESTERN HIMALAYAS.—Sketch map showing the route of the Bullock Workman Expedition from Srinagar to the sources of the Chogo Lungma Glacier. 1902–3. Scale, 1,750,000, or 11.83 statute miles to an inch. With inset showing the Chogo Lungma, Alchori, Hoh Lumba, and Sosbon glaciers surveyed by the Expedition, on a scale of 1:250,000, or 3.9 statute miles to an inch. *Geog. Jour.*, March, 1905, London.

These maps are from a plane-table survey by Mr. B. H. M. Hewett, corrected by Dr. and Mrs. Workman, and adjusted to the Indian Government Survey. An excellent idea is given of this complex of great glaciers and their feeding-grounds. The highest point attained, 23,394 feet, on Pyramid Peak, a little over 1,000 feet below its summit, was reached by ascending Basin Glacier, one of the feeders of Chogo Lungma.

OCEANIA.

PACIFIC OCEAN.—Insel Guam. Scale, 1:225,000, or 3.5 statute miles to an inch. *Petermann. Mitteil.*, No. 2, 1905. Justus Perthes, Gotha.

The map is based upon the U. S. Surveys, 1901–2, and has been reduced from our Hydrographic Office chart of last year. Brown tints indicate the hill features; heights and the soundings in San Luis d'Apra Harbour are indicated in metres. Native paths and drainage are shown, and the map is a good generalisation of the recent survey work.

ATLASES.

STIELER'S HAND-ATLAS.—Neue neunte Lieferungs-Ausgabe. 100 Karten in Kupferstich. Parts 41 and 42. Justus Perthes, Gotha, 1905. (Price, 60 pf. for each Part containing two map sheets.)

Especial interest in this instalment of the atlas attaches to No. 5, the North Polar Chart, and No. 6, the South Polar Chart, both by H. Habenicht. The latitudinal scale of the Arctic sheet is 1:20,000,000, or 315.6 statute miles to an inch, which is double the scale of the Antarctic sheet. Both charts, especially the North Polar, show many contrasting colours, that not only define sharply the information presented, but also increase the attractive appearance of the maps. Many changes from the sheets they supersede are, of course, observed. In both charts the routes of explorers have the colours assigned to their mother countries, and two colours are given to British routes, one showing routes before and the other during the Nineteenth Century.

The greatest changes in the North Polar chart have been produced by Peary's survey in the extreme north of Greenland, Sverdrup's discoveries west of Ellesmere Land and Grant Land, the Scandinavian surveys of parts of the coast of east Greenland, and the work of Jackson, Nansen, and the Duke of the Abruzzi in Franz Josef Land, which has completely changed the earlier ideas as to the extent and distribution of land in this archipelago.

An innovation on the South Polar chart is the distribution of seaweed, which girdles the Antarctic waters north of the 60th parallel. This beautiful chart shows very clearly the inroads that have been made in unknown Antarctica by the expeditions beginning with Larsen's cruise and that of the *Belgica*. The numerous insets in both charts on a larger scale give many details of the results of recent Polar discovery. The name West Antarktis (West Antarctica) is here first attached to the part of the continent that widens out south of Graham Land.

The other two sheets are 3 and 4 of the German Empire, on a scale of 1:1,500,000, or 23.67 statute miles to an inch. They are a revision by C. Scherrer of the late C. Vogel's well-known map of Germany in this atlas.

ATLAS UNIVERSEL DE GÉOGRAPHIE.—Ouvrage commencé par M. Vivien de Saint-Martin et continué par Fr. Schrader. No. 46, Asie en 10 Feuilles (Feuille 1, Asie Mineure et Caucasie). Scale, 1:5,000,000, or 78.9 statute miles to an inch. Librairie Hachette et Cie, Paris, 1903.

This is Sheet 1 of the 10-sheet map of western central, eastern, and southern Asia, including all of it except Siberia, which has already appeared. As in all the previous sheets of this atlas, the work of the geographer and cartographer is of the highest quality. No one skilled in map-reading can examine the sheet without pleasure. The Caucasus Mountains and the ranges of northern Persia would test the skill of the most expert map engravers; and it is not too much to say that the orographical aspects of these regions are here defined with wonderful clearness and intelligence, as far as explorers and surveyors have supplied the essential data. A small omission that may easily be remedied is the absence of the minus sign before the figures 26 in the Caspian Sea to indicate that its surface lies 26 metres below the level of the Black Sea. All the Turkish, Persian, and Russian geographical terms employed on the map are defined.

ACCESSIONS TO THE LIBRARY.

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VOLLKOMMER, MAX.—Die Quellen Bourguignon d'Anvilles für seine Kritische Karte von Africa. Gekrönte Preisschrift. *Münchener Geographische Studien S. Günther, 16. Stück.* München, Th. Ackermann, 1904. pr., 8vo.

WEBER-VAN BOSSE, MEVROUW A.—Een Jaar aan Boord H. M. Siboga. (Kaart, etc.) Tweede Druk. Leiden, E. J. Brill (1904). Square 8vo.

WHITAKER'S ALMANACK, 1905.—London, J. Whitaker. 8vo.

WHO'S WHO, 1905.—An Annual Biographical Dictionary. London, Adam and Charles Black. 8vo.

BOOK NOTICES.

Weltwirtschaftliche Neubildungen. By Paul Dehn. (Second Edition). viii and 366 pp. Allgemeiner Verein für Deutsche Litteratur, Berlin, 1904.

A series of essays on economic and industrial questions in their broadest relations. A few of the titles give a good idea of the scope of the book: "The Development of World Industries," "Tariff Wars," "National Depreciation of Foreign Products," and "Bankrupt States." While the author writes with much ability and information his clarity of vision may be impaired in many matters by his tendency to regard the United States of America as dangerous to the wellbeing of Europe.

Svenska Turistföreningens Årsskrift för År 1904. viii and 463 pp., 200 Illustrations and 5 Sketch Maps. Wahlström & Widstrand, Stockholm, 1904.

A description of Sweden, with special reference to information required by tourists. Numerous routes are given and many half-tone illustrations show various aspects of the country, including the fishing fleets.

Allgemeine und Spezielle Wirtschaftsgeographie. By Dr. Ernst Friedrich. 370 pp., 3 Maps and Index. G. J. Göschen'sche Verlagshandlung, Leipzig, 1904. (Price, M. 6.80.)

Dr. Friedrich has recently attracted much attention as a writer on economic geography. It is doubtful if any other writer on the subject has made so enormous a collection of facts as he has done to illustrate this department of geography; and his systematic classification of this material has enabled him to use it very effectively in his writings. The present work is neither a textbook nor a handbook, though it may be read with great profit by advanced students; and the vast array of facts minutely indexed gives the work, in many respects, the quality and usefulness of a handbook.

But the serious purpose of Dr. Friedrich is to show that the method of treating economic geography which he has brought to the front is essential to the most effective study of it. He desires to emphasize man as the great factor in economic geography, and he gives the secondary place to natural conditions. He asserts that S. Günther and other German writers are wrong because they begin their consideration of economic geography with the natural environment and conditions instead of with man and his various forms of industry.

Dr. Friedrich and the other writers, however, do not seem to be very far apart, and both effectively present the subject. So important are environment and other natural conditions in determining the nature and quantity of industrial products that it is not strange if most writers on economic geography make the inter-relations between man and the natural conditions around him very prominent. Their treatment of the subject justifies the use of the term "economic geography," while Dr. Friedrich's method seems to relegate the topic to some branch of economics.

In the development of his method Dr. Friedrich shows man and his industrial activity in process of evolution—first, the stage of animal economy (*tierische Wirtschaft*), in which man, like the lower animals, satisfies his wants merely by collecting the articles needed for his food, clothing, and shelter. In the second stage of instinctive economy man is aided by his instinct in collecting the necessities of life, he has invented more implements to help him than he possessed in the first stage of struggle and progress is made in agriculture and stock-raising. In the third stage he has the advantage of traditions handed down orally, or even reduced to writing, so that in this era of traditional economy he may benefit by the experience of his fathers. The fourth stage is that of scientific economy, when various peoples have obtained an insight, more or less profound, into the relations between man and nature, and have learned in a high degree to utilize natural forces for man's benefit.

Nearly one-fourth of the book is devoted to the development of these ideas, and the remainder, exclusive of the index, is given to the special consideration of the various countries, an enormous number of facts being cited. Their application to the basal features of the study, as propounded by the author, must be made by the reader, as most of the facts are stated baldly, with no attempt to show their relation ships. One of the three maps shows the areas now occupied by man in each of the four stages of economic culture; another shows the distribution of the forms of industry from collections of vegetable products, such as rubber, through fisheries, hunting, planting, stock-raising, and mining to manufactures, transportations, and trade. The third map shows the economic zones as determined by climate. The author has certainly enriched the study of economic geography on the human side, and for this and the wealth of illustrative and accurate fact which he has collected his writings cannot be overlooked in any satisfactory study of this subject.

Uit de Dagen der Compagnie. By N. P. Van Den Berg. 419 pp. No Index. H. D. Tjeenk & Son, Haarlem, Netherlands, 1904. (Price, paper fl. 3.90, cloth fl. 4.50.)

The author treats ten historical topics relating to the Dutch East Indies when they were under the rule of the East India Company. Among them are "Five Years in Banda" (1633–38); "A Petition of the People of Batavia" (1648); "The Theatre in Batavia in Early Times," "Early Reports on Krakatau. The Eruption of 1680;" and "The Sugar Industry of Java under the East India Company."

Pathfinders of the West. By A. C. Laut. xxv and 380 pp., 58 Illustrations, 3 Maps, Appendix and Index. The Macmillan Company, New York, 1904. (Price, $2.)

In this book Miss Laut tells the story of the great journeys in the western and northern part of North America of Radisson, De la Vérendrye, Samuel Hearne, Alexander Mackenzie, and Lewis and Clark. Nearly half the volume is given to Radisson, a French pioneer who antedated Marquette, Joliet, and La Salle. Most encyclopædias have failed to mention Radisson, though he had a genius for pioneering, was absolutely fearless, courted the most dare-devil adventures, tramped over much of the Mississippi valley between Missouri and Minnesota where no white man had preceded him, went overland to Hudson Bay, was instrumental in forming the Hudson Bay Company, and was denounced by many of his contemporaries as a rascal. Miss Laut claims for him the honour of being the great original pathfinder of the West, and denies that Marquette, Joliet, and La Salle were pathfinders at all, because Radisson and his brother-in-law "had discovered the West" twelve years before they had thought of visiting it.

The proof is adequate that Radisson travelled extensively even to the west of the Mississippi, and Miss Laut is to be thanked for helping to rescue from oblivion the name of the man who was as remarkable for his sufferings and hair-raising adventures as for his achievements. But if Radisson was a pathfinder and his contemporaries did not deserve this title they at least left records and maps by which we can tell where they saw many of the geographical aspects they described. It is difficult to put one's finger on Radisson in the wide field of his wanderings, and it is often impossible to say much more than that he "was there or thereabouts." The prizes of discovery or geographic instinct were not the chief impelling influences that led him on, but they were the love of adventure and, above all, the quest for furs; and it was not policy for him minutely to reveal his itineraries.

Miss Laut's story of Radisson and her narrative of the great journeys of other explorers in this volume are full of animation and sympathy. She has the art of putting things, and her readers see with her the very life and breathe the air of the pioneer days in the West. She thoroughly knows the West and its history; and few writers on the pathfinder days of the northern two-thirds of North America have so vividly and accurately portrayed, as she has done, the adventures of the pioneers of discovery, the perils they met, and the life they saw. The present volume fully sustains her reputation.

Rapport à M. le Ministre des Colonies sur les Richesses Minérales de la Nouvelle-Calédonie. Par M. E. Glasser. 545 pp. and 6 Plates. Vve. Ch. Dunod, Paris, 1904. (Price, frs. 10.)

The author had charge of a Government mission to this Pacific island to study its principal mineral resources. He is a mining engineer, and his report adds con-

siderable detail to our knowledge of the mineral wealth of New Caledonia, which is unusually blessed in this regard. He gives three chapters to the geology of the island, and describes the nickel and cobalt mines with much fulness. Copper and other minerals are also described, and nearly 100 pages are given to the coal mines. The plates show the present state of mining development in some of the principal regions. This island and Canada supply nearly all the nickel of the world, and New Caledonia is practically the only source of cobalt.

The Mediterranean Traveller. A Handbook of Practical Information. By D. E. Lorenz. 367 pp., 90 Illustrations, 15 Maps and Plans, and Index. Fleming H. Revell Company, New York and Chicago, 1905. (Price, $2.50.)

Especially prepared for those who visit chiefly the important coast cities. The author's purpose was to arrange just the information desired of the Mediterranean coast show-places, omitting the inland regions, excepting the Holy Land, Egypt, Italy, and Southern Spain, whose various points of interest are fully described. The book will meet the need of such tourists as do not intend to penetrate to many places behind the coasts, to which most guide-books devote the larger part of their space. A page of condensed statistical information and a short bibliography for each country described are useful features. The letterpress is not in the dry style of the ordinary guide-book, but is pithy and interesting in its way of calling attention to things to be seen and remembered.

The large granite columns recently placed in position at the Cathedral of St. John the Divine on Morningside Heights, New York, weigh ninety tons each. This volume tells of three blocks of stone in the enclosing wall at the Great Temple of Baalbek, which are from 62 to 64 feet long and about 13 feet square, each weighing about 1,000 tons.

How these monster stones were brought from the quarry a mile away and raised, as in some instances, to a height nearly a hundred feet foom the ground will, perhaps, forever remain a mystery, especially as it is asserted that the temple was built before the invention of the lever or the derrick. The usual theory is that they were rolled up an inclined plane of earth especially prepared for the purpose.

Near the quarry itself lies an even larger stone, some seventy feet long and fifteen feet wide, weighing about 1,500 tons, the largest single stone ever quarried and removed from its original place.

A good map in colours shows the communications between the coasts and all parts of Europe. The black maps of countries and the plans of towns are, most of them, on too small a scale and too inadequately executed to be serviceable.

The Garden of Asia. Impressions from Japan. By Reginald J. Farrar. xi and 296 pp. Methuen & Co., London, 1904. (Price, 6 sh.)

A book of impressions rather than of information. The author set himself a difficult task in trying to translate into words the charm that Japan has for the discerning. It is for those who have genuinely felt the charm to say whether his words have adequately translated it. But many who have never seen Japan will agree that these word-pictures make very pleasant reading. This extract, from the chapter on "Shops and Shopping," is a fair sample of the volume :

In the matted inner room sits a beautiful aged man, with the air, the bearded dignity of a sanctified sage. Reluctantly, and with no desire to sell, he produces for us small gems, Chinese cups and bottles —wonderfully glazed and enamelled with jewels of colour—or green saucers of ade, or the refinements of some Japanese toy in bronze. Everything on his shelves has an air of meticulous cleanliness that suits with its dainty elegancies of contrivance.

So, without any enthusiasm, the old prophet sits among his treasures, dreading the necessity of selling any. He remains immovable in the matter of price. He does not want you to buy his darlings and

carry them away. But, if you really desire them, well, you can take them at his valuation or leave them. And he would prefer this latter alternative. However, the purchase once completed, he follows David's sensible example after his baby's death, and becomes cheerful in the face of the irremediable. He goes into another room, leaving us with the cakes and tea that he has ordered for our entertainment, and returns in a moment with some little fragile, charming present of courtesy—some little carving in wood or kettle in coloured faience. So he bows us out and returns to his meditations in the fragrant dusk of his cavern.

The Australian Handbook (including New Zealand, Fiji, and New Guinea) for 1905. 676 pp., Directory and Business Guide, 223 pp., 4 Pictures, 34 Maps and Index. Gordon & Gotch, London, Melbourne, etc., 1905.

Contains a large variety of facts important for every one who wishes special information about the Australian Commonwealth and other British possessions in the Pacific Ocean. Much space is devoted to the exploration, the geography and geology, resources and statistics of each State and colony. All towns are briefly described, and the tariff schedules, land and mining regulations, etc., are given. The maps include black railroad maps of each State and colony, coloured maps of the same subdivisions; plans of Perth, Melbourne, Adelaide, Wellington, Auckland, Dunedin, Christchurch, and Brisbane; the distribution of minerals in New South Wales, and 4 maps in colours showing the present condition of exploration in Australia, its orographical features, mean annual rainfall, and distribution of vegetation and cultivated crops.

Wanderings in the Great Forests of Borneo. By Odoardo Beccari. Translated by Dr. Enrico H. Giglioli, and revised and edited by F. H. H. Guillemard. xxiv, and 424 pp., 61 Illustrations, Maps of Borneo and Sarawak, Appendix and Index. Archibald Constable & Co., Ltd., London, 1904. (Price, 16s.)

Dr. Beccari only recently prepared for publication this account of his researches in natural history in Sarawak, North Borneo, though the work he describes was done nearly forty years ago. The scientific world will be glad that he yielded to the advice of his friends and has written this interesting and sympathetic story of nature as he found it in Borneo. The work is not out of date, because, as Lady Brooke told Dr. Beccari and as Dr. Guillemard assures his English readers, the vast primeval forests through which the author leads the way in so interesting a manner are to-day as they have been from almost the beginning of things. This record of his early work in Borneo comes after many years of travel and exploration, whose scientific results have been published and whose collections have enriched the great museums of Italy and other countries. His wide knowledge of his special topics gives much value to his descriptions and his theories, though many may not agree with his views as to the origin of species.

The Cultivation and Preparation of Para Rubber. By W. H. Johnson. viii and 99 pp., 6 Illustrations and Index. Crosby Lockwood & Son, London, 1904. (Price, 7s. 6d.)

The fact that the supply of rubber collected from trees and vines growing wild in the forests, bids fair, before many years, to be inadequate for the needs of commerce, gives large importance to the present efforts to develop rubber plantations. Many of these enterprises have met with poor success, as was to be expected in the stage of experimentation. Rubber-planting, however, is increasing in Brazil and in the Congo Free State, and has prospered in an exceptional manner in Ceylon and the Malay Peninsula, where it is developing into a large industry.

The Pará rubber tree (*Hevea brasiliensis*) is the plant that seems to have flourished

best in the plantations of nearly every region where it has been introduced. As it also yields the best quality of rubber in the market, it is highly favoured by planters. There are now about 1,200 acres of *Hevea* trees in Ceylon and a still larger area in the Malay Peninsula.

The Government of the Gold Coast Colony, West Africa, in which Mr. Johnson is Director of Agriculture, sent him in 1902 to Ceylon to study the methods employed there in the cultivation of Pará rubber and other agricultural staples for market, with a view to introducing them into West Africa. This book is devoted to Pará rubber, and it will be very helpful to the increasing number of persons who are taking up rubber cultivation in Africa and other parts of the tropics.

It describes the Pará rubber tree in its native home and abroad, tells what experience has shown as to the best methods of cultivation, devotes a chapter to the insect pests and the fungoid diseases that attack it, gives the methods of rubber-collecting and the preparation of rubber from the latex, treats of the yield from cultivated trees in various regions, and makes suggestions as to the establishment and maintenance of a Pará rubber plantation. The author says that there are in tropical Africa thousands of square miles of land suitable for the cultivation of this rubber tree. A large part of this land has been occupied by rubber plants, which have been greatly diminished in number by the destructive methods of tapping employed by native collectors.

The Travels of Marco Polo the Venetian. Translation of Marsden revised by Thomas Wright. xxxix and 461 pp., Portrait of Marco Polo, Maps, 4 Appendices and Index. George Newnes, Limited, London, 1904.

In this edition of the standard translation of Marsden revised by Wright, their notes have been further revised, and a series of maps illustrating Marco Polo's travels, a list of contemporaneous events, and an exhaustive index have been added. It is a handsome and not an expensive volume, and may easily be carried in the pocket.

Through the Unknown Pamirs. By Lieut. O. Olufsen of the Danish Army. xxii and 229 pp., 58 Illustrations, 3 Maps and Index. William Heinemann, London, 1904.

This is a distinct contribution to our knowledge of the Pamirs. It is in no respect a narrative of travel. In his preface the author names the regions of the Pamirs that were the field of his studies. In the body of the book he scarcely alludes to his experiences, but reserves his pages for full descriptions of what he learned of the "Roof of the World" and its inhabitants during his two journeys in 1896–1899. Well equipped as Lieut. Olufsen is for geographical and anthropological investigations, his book is filled with new and valuable information, presented in a very readable form. The numerous photographs show a large variety of the aspects of the country and its inhabitants. Lieut. Olufsen's two expeditions covered the south Pamir from the territory around the River Gund and the Alichur Pamir to the Hindu Kush.

Per la Manciuria a Pechino. Salvatore Minocchi. 360 pp. and 58 Photographs. Libreria Bernardo Seeber, Florence, 1904. (Price, lire 4.)

An animated account by an Italian traveller of a recent rapid journey through Manchuria across the Great Wall and to Tientsin and Peking. His descriptions are lively, and many of them relate to districts that the war has brought prominently into view. He gives a long chapter to Harbin, "the Russian capital of Manchuria," devotes 70 pages to Mukden, and describes at length Port Arthur and the large Chinese cities he visited. The pictures are excellent.